THURSDAY, MAY 24, 1894.

PRACTICAL PAPER MAKING.

Practical Paper Making. By George Clapperton. (London: Crosby Lockwood and Son, 1894.)

THE book before us is not without value. The chapters devoted to paper-making proper, that is, to the mechanical details of the art, contain a great deal of useful information; and although "experience" must be classed as of the "incommunicables," the notes and observations of an experienced man serve to concentrate the attention of the less experienced upon those points, the mastery of which constitutes technical skill. Technological handbooks, however, ought in our opinion to possess the higher *educational* value belonging only to those which preserve the perspective of the subject of which they treat. A book, like a lecture, must be diagrammatic to be effective educationally; and in this sense it must be an artistic production. We do not by any means imply that a certain level of literary style must be attained and maintained. In the "literature" of the industrial and physical sciences we must be content, it would seem, with the irreducible minimum of "Queen's English." What we do imply is the infusion of personality, in the clear grasp of principles, and in the consequent development of the subject-matter according to its natural perspective. Judged from this stand-point, "Practical Paper Making" must be labelled "found wanting." If we apply to the art or industry the crude criterion of money values, we find that in the production of paper the proportion of costs, for raw materials, and their chemical treatment, are in this, in comparison with many other industries, unusually high; this being "practically" interpreted, means that chemistry is of first importance in the mill. The author makes an oblique confession of his convictions in this direction in his opening sentence: "As the chemical and physical characteristics of the materials . . . . determine to a marked degree the qualities of the finished product, a thorough grasp of these characteristics is indispensable to all who aim at the production of the best possible results with the minimum of cost." We are quickly reminded, however, of the adage, "red dawning shepherd's warning," as the author plunges at once from the sunshine of first principles into a much less promising treatment of practical matters, opening with the following remarkable sentence:—

"The percentage of cellulose—or to use a term more readily understood by paper-makers, the amount of available paper-making material—varies with the plants from which it is obtained, and the treatment to which it is subjected. . . . ."

Comment would be superfluous. He then proceeds to extract comfort from "the chemical formula of cellulose—$C_6H_{10}O_5$—which means that six equivalents of carbon, ten of hydrogen, and five of oxygen are united together to form the substance known by that name." This evidently has the effect upon the practical paper-maker which is recorded of the "blessed word Mesopotamia" in another sphere of experience. That is all as to cellulose proper! "Oxycellulose" is then alluded to, and described as possessing "an extraordinary affinity for *vanilline* compounds, uniting with them from solutions containing infinitesimal proportions." It would be thankless criticism to single out mere mistakes from what might be in other respects good matter; but the mistakes in this work are as slovenly as the matter—"vanilline" for "vanadium" (p. 2), and "hypochlorite," used on three successive occasions, for "hyposulphite" (pp. 29–30), are typical mistakes; and for looseness of construction, which characterises the matter throughout, we commend the following example:—"Sulphate of alumina is not a chemical compound of a definite composition, as the alumina varies between 2 and 3 per cent., though that purchased from reliable makers generally contains 15 or 16 per cent." (pp. 71–72). If the author's want of precision were an occasional lapse merely, with the effect of befogging a particular point, we should not have challenged the work upon the issue we have raised; but it extends to the entire ordering and treatment of the subject-matter. The sources from which the author has compiled his account of the chemical processes of the mill are familiar to us. He has probably aimed at reproducing what he may consider the essential and practical features of the originals. But the result is a second-hand and garbled version, and in many important places, more especially where effects are discussed in relation to causes, essentially wrong. Thus (p. 6) "jute fibres" are described as "strong but very difficult to bleach white, and if subjected to such treatment as will dissolve all the extraneous matter and reduce to ultimate fibres, their original strength is much impaired." The facts are that jute is easily bleached white, but then is no longer jute but jute-cellulose; and on the structural question the destruction of the *filament* by no means implies disintegration of the *ultimate fibre*. Then again (p. 7), "Straw fibres are very similar in appearance to esparto, but shorter and more highly polished, tending to make their filling power much less, and rendering paper made from them very brittle." In another place (p. 47), "Papers made from straw are, owing to the hard nature of the ultimate fibres, very hard and brittle." Any explanation appears to some minds better than none, even a re-statement of the fact to be explained, in somewhat varied terms. It does not occur to the author that straw "cellulose" differs constitutionally from esparto, and with these differences are correlated not only the relatively low yields of bleached straw pulp (which the author labours to explain on p. 40), but generally its relationships to oxygen and water (hydration), and these again with its paper-making qualities.

It would serve no useful purpose to continue our criticisms. The best we can say of the work is that it represents a good deal of thought on the part of a man skilled in his art, and struggling to compass the science upon which its successful practice primarily depends. It may be that in this endeavour the author has followed the classic maxim: "If you want to learn a subject, write a book upon it."

To those who will bear in mind that the chemical part of the work is a compilation, not well digested, and in some places unsound, we have no hesitation in recommending it.

THE THEORY OF OPTICAL INSTRUMENTS.

Theorie der Optischen Instrumente (nach Abbe). Von Dr. Siegfried Czapski. (Breslau: Eduard Trewendt, 1893)

HAPPENING not long ago to meet a German friend well posted up in physical literature, the present writer inquired whether any of the year's publications were specially worth getting and reading. The answer was a doubtful "No," and then "Oh, yes—Czapski's 'Theory of Optical Instruments.'" This was high praise, but not unmerited. For although the book will not appeal to a large circle of readers, it will soon become indispensable to all who are interested in the investigation of the merits and defects of optical systems, or who are concerned in turning out high-class optical work.

Although only a third of the book is devoted to the description of the microscope, telescope, and other instruments, there is no unnecessary rambling beforehand—either into the pleasant regions of developmental history or along the more dusty paths of the optical text-book proper. The author acknowledges the value of the undulatory theory as the ultimate test which must be applied when we wish to know how far the conclusions of geometrical optics are valid; and therewith dismisses it. He everywhere tries to be concise; and succeeds so far that the average student might complain of sometimes finding a day's work between one page and the next. But the condensation is not of that meaningless kind which so often irritates one in German school and college text-books. There are frequent (and valuable) bibliographical notes. The references to the works of Smith, Herschel, Lloyd, Airy, Rayleigh, Dallinger, and Pendlebury show that the English literature has not been neglected; indeed, Principal Heath's "Treatise on Geometrical Optics" (which is being translated into German) is recommended as the best of the modern text-books. But whereas these tend to treat optical instruments as convenient illustrations of optical theory or geometrical reasoning, the latter are here treated as strictly subservient to the former. The range is further limited by including among optical instruments only those which are strictly used for producing images of external objects—applications of reflecting mirrors in geodesy and astronomy, the stereoscope, &c., being included. Within these limits our author is at home and speaks with authority. As scientific adviser and technical director in the celebrated workshops of Carl Zeiss in Jena, he has daily opportunities of applying theory to practice with the aid of excellent glass, skilful workmen, and modern machinery; and has had the still greater advantage of continual intercourse with Prof. Abbe, to whose labours the perfection of high-power microscope objectives is so largely due. His debt in this direction is freely and gratefully acknowledged—most conveniently by stating what chapters are not directly or indirectly due to Abbe.

A short introductory chapter on geometrical optics is followed by three others on the geometrical theory of optical images, the fundamental properties of lenses and systems of lenses, and the theory of spherical aberration. In chapter v. (on chromatic aberration and the theory of achromatism) the author gives a simple method for calculating the magnitude of the secondary spectrum (the focus-difference) of a system of two infinitely thin lenses from the dispersion-constants. Assuming these to be achromatised for the lines F and C, he calculates the difference between the focus for light of a given wave-length (λ) and the light of the brightest part of the spectrum $\lambda = 0{\cdot}55\ \mu$. (According to König the position of maximum brightness in the spectrum of sunlight varies, as the total intensity increases, from $\lambda = 0{\cdot}53\ \mu$ to $\lambda = 0{\cdot}61\ \mu$.) The values of the differences $f_\lambda - f_{0{\cdot}55\ \mu}$ are given in thousands of $f_{0{\cdot}55\ \mu}$ for various wave-lengths. In the case of a combination of a flint glass of medium density with an English silicate-crown glass the differences decrease from + 1·79 (for $\lambda = 0{\cdot}77\ \mu$) and then gradually increase to 3·70 (for $\lambda = 0{\cdot}41\ \mu$). But the researches of Prof. Abbe and Dr. Schott have resulted in the production of improved grades of optical glass, and especially of pairs of flint and crown glass in which the dispersion in various parts of the spectrum is much more nearly proportional. These glasses have been manufactured in the Jena works since 1884, and by their use the magnitude of the secondary spectrum is greatly diminished. Thus in the case of a combination of a heavy barium-phosphate-crown glass with a borate-flint glass the above differences begin at − 0·04 (for $\lambda = 0{\cdot}77\ \mu$) and the maximum value is 0·79 (for $\lambda = 0{\cdot}41\ \mu$). Curves are given illustrating these results which have been confirmed by direct measurements of focus-differences of telescope-objectives made by Vogel, Hasselberg, and Wolf.

Chapter vi. contains an unusually complete and systematic treatment of prisms and systems of prisms, partly based upon Dr. Czapski's own investigations. The next chapter is devoted to stops and aperture, and the properties of an optical system which depend upon aperture, such as penetrating power and brightness. It is shown that in any instrument used for subjective observation the penetrating power (*i.e.* the total depth of vision) is exactly equal to the sum of the depth of focus of the objective and the accommodation-depth of the eye—a result which is of the greatest practical importance in microscopy. Next comes what is perhaps the most interesting and important chapter—that which deals with the principal types of optical instruments. The book closes with an account of the methods for determining the constants of optical instruments. Some of these will come as a revelation to students who are only familiar with the comparatively rough methods described in the ordinary text-books on practical physics.

Dr. Czapski appears to have at first intended to include in the book a tolerably full account of Abbe's theory of microscopical vision. One cannot help regretting that this intention was abandoned. A letter of his on "The Future of the Microscope," which is printed in van Heurck's sumptuous book ("The Microscope," English edition, pp. 357–364) shows his ability to present such a matter, not only with his usual accuracy, but in a fairly popular form. We understand that a separate volume on this subject may be expected from Prof. Abbe or Dr. Czapski, or both.

pv.

CHEMISTRY APPLIED TO AGRICULTURE.

Manures and the Principles of Manuring. By C. M. Aikman, B.Sc., F.R.S.E. Pp. xxx., 592. (Edinburgh and London: W. Blackwood and Sons, 1894.)

IT was rather more than fifty years ago, in the year 1840, that Liebig presented to the British Association his classical report on "Organic Chemistry in its Applications to Agriculture and Physiology." In this, among many bold and startling statements, we find such sentences as the following:—"As there is no profession which can be compared in importance with that of agriculture, so there is none in which the application of correct principle would be productive of more beneficial effects. Hence it appears quite unaccountable that we may vainly seek for a single leading principle relative to this subject in all the writings of agriculture and of vegetable physiologists." "Also, when we inquire in what manner manure acts, we are answered by the most intelligent men that its action is covered by the veil of Isis; and when we further demand what this means, we discover merely that the excrements of man and animals are supposed to contain an incomprehensible something which assists in the nutrition of plants and increases their size. This opinion is embraced without even an attempt being made to discover the component parts of manure, or to become acquainted with its nature." In this, as in other of Liebig's statements, there was much exaggeration. Sir Humphrey Davy, De Saussure, and other labourers in the field of scientific agriculture had not lived in vain. Liebig's writings, however, were productive of much good, and stirred up a great deal of interest in agricultural chemistry which led to many important results. Within a year or two before the date mentioned and five or six years after, not only were most of the more important artificial manures, now extensively used, brought into notice and experimented with, but several important writings on manures and manuring were published. Suffice it to say that to this epoch is due the introduction of guano, of nitrate of soda, and of sulphate of ammonia as manures; and that Mr. Lawes (now Sir John Bennett Lawes) took out his patent for the manufacture of superphosphate in 1842; now nearly a million tons of this manure are made annually in this country alone. Two or three important manures, such as the potash salts of Stassfurt and Thomas' basic slag, are of later introduction. To illustrate the attention then given to the subject of manures and manuring generally, and to these new manures in particular, we may note that the second volume of the *Journal of the Royal Agricultural Society of England*, published in 1841, contains a paper by the Sibthorpian Professor of Rural Economy at Oxford, Dr. Charles Daubeney, "On the scientific principles by which the application of manures ought to be regulated," including results of many experiments; also an article by Prof. J. F. W. Johnston, "On Guano," and the results of experiments by numerous agriculturists with nitrate of soda, saltpetre, bones, and gypsum.

Within a very few years of this date Prof. Johnston published his Lectures, and Cuthbert W. Johnson published a very useful and interesting book "On the Fertilisers." It is almost needless to remark that the immortal experiments of Rothamsted were put on to a firm and systematic basis in 1843.

Since that time agricultural chemistry, including a knowledge of the principles of manuring, has steadily pursued its way, fostered by a host of workers, not only in this country but on the continent, and lately in the United States. The last few years have shown some revival of the public interest in the applications of science to agriculture. This has, we think, been brought about partly by the spread of technical education in the rural districts; but also partly byt he continued low prices of agricultural produce, which make it imperative on the farmer, if he would continue to survive, to use every good implement, mental or otherwise, he can in furthering his business.

Although many little books have been lately published in this country on the subject of manures, we may safely say that none of them are so satisfactory as that of Mr. Aikman. Though in some respects incomplete, it is a welcome addition to the literature of the more scientific side of agriculture. The first part of the book is a short historical introduction of 60 pp.; this is good, but too short. Part ii. is on the principles of manuring. It deals with the fertility of the soil, illustrated by and due to its physical, chemical, and biological properties; with the functions performed by manures, and the positions occupied by nitrogen, phosphoric acid, and potash in agriculture, and with nitrification in soils. The treatment of the biology of the soil is all too scanty. Part iii., more than half the book, treats of manures. The most important chapter is on the most important manure—farmyard manure—and this is well treated. Other chapters are on guano, nitrate of soda, sulphate of ammonia, bones, mineral phosphates, superphosphates, basic slag, potassic manures, indirect manures, which include lime, gypsum and salts, the application of manures, manuring of farm crops, the valuation and analysis of manures; and a final chapter giving the results of some of the Rothamsted experiments. There is a very short chapter on sewage, which is inadequately dealt with, and the minor manures are very scantily treated; seaweed is not even mentioned as a manure, and rape-cake and other oil-cakes are only casually alluded to. Generally, Mr. Aikman has done his work carefully and well, and presented the results in a clear and readable form, which will commend itself to his readers. As we confidently expect a new edition ere long, we may perhaps be pardoned for pointing out some of the minor defects of the book. More frequent references should be given to original papers; this might be done without unduly enlarging the volume. The explanation of "unit" values of manurial ingredients is hardly intelligible to one who first comes across it here. On p. 380, the last sentence is wrong; probably the word *only* is omitted. On p. 43, Beyerinck would hardly recognise his name in the way it is spelt; why should the words *glycin* and *glycocoll* be used on consecutive pages as though they denoted different substances; why should carnallite be sometimes spelt with a *c* and sometimes with a *k*, even in the index; also why are sylvine and kainite denied the final *e* usually accorded to minerals in this language?

The scheme of experimental plots, on p. 546, would be made more complete by including an eighth plot manured

with phosphates, potash, and nitrogen. The valuation of unexhausted manurial residues, whether derived directly from manures or from foods, might well receive more attention.

The book is a genuine effort to treat the subject scientifically, and at the same time in a manner intelligible and interesting to the farmer of good education. We think it has succeeded. E. K.

LATITUDE BY EX-MERIDIAN ALTITUDE.

The "Ex-Meridian" treated as a Problem in Dynamics, &c. By H. B. Goodwin. (London: George Philip and Son, 1894.)

THE author of this brochure, with a tinge of satire, seems to apologise for its containing nothing about the already exhaustively developed Sumner method. In doing this he alludes to "the too just Aristides." This reminds us of a saying of that practical philosopher, that "the best way to appear just is to be so." The proverb may teach us that the way to obtain dependable results is to have a firm grasp of principles, that the most reliable navigator is one who understands the theory of his problems.

This remark is apposite, for we can conceive many a "simple sailor" being rather frightened at the title of this pamphlet which will first meet his eye, and we hear him say—"Cannot the seaman continue to navigate his ship without learning dynamics?" If he has courage to read a little further on, he finds that his belovedly simple "Sun Mer. Alt." connected with such words as "maximum" and "minimum." Hitherto he has banished the word "maximum" from his thoughts by avoiding the use of the moon and planets for finding the latitude at their culmination; considering that the problem—"To find the time when the moon and planets are at their maximum altitudes" to belong to "the gymnasium of the examination room" rather than to "the arena of every-day practical utility." But now he finds that modern ships require this problem to be considered with reference to all the celestial bodies, and that even the sun may be capricious enough not to "dip" at noon, that, in fact, instead of this phenomenon giving a meridian altitude it gives an ex-meridian altitude which has to be reduced to the meridian.

There is reason to be thankful for this new feature, because it will attract more attention to the hitherto shamefully neglected method of the ex-meridian among ordinary navigators. That this can be no longer thus relegated is exemplified by Mr. Goodwin, as follows:—

"In the *Standard* newspaper of October 23, 1893, it is stated that H.M.S. *Royal Sovereign*, flag ship of the Channel Squadron, had arrived at Gibraltar, having made the passage in less than seventy hours. Such a passage as this has ceased to be regarded as phenomenal, and is looked upon as quite an every-day occurrence. For a portion of the voyage a speed of over fifteen knots was maintained, and on board a ship steaming at this rate nearly due south, at that time of year, the sun would not appear to 'dip' until more than five minutes after noon, and a correction of nearly 45″ would be necessary to reduce the maximum altitude to the meridian."

As the ship moves south a fresh horizon comes into view, and the sun will appear to rise until this shift of the horizon (the rate of which depends upon the rate of the ship towards the sun) is less than the rate of his motion in altitude.

There is another reason for being thankful for the sun having to be thus treated at the noon-day observation. It will lead to the moon and planets being no longer avoided for finding the latitude at the time of their culmination. No celestial bodies are more useful for such a purpose, especially at twilight, when a well-defined horizon is frequently available.

Every practical navigator daily uses the *Nautical Almanac*: it would be well if he devoted a short time also to study the "Explanation" at the end of the volume. In explaining "*Var. in* 1 *hour*" which occurs on every page I. of the book, it is stated that this "is the variation at *noon*, and requires to be reduced to midway between noon and the time at which the R.A., Dec., or Eq. of time is required"; in other words, the reduction of the quantities from apparent noon to any other time is a problem in dynamics. The moving body is subject to a uniform acceleration in the direction of its motion, and the space described in a given time is found by multiplying the *mean velocity* during the time by the given time. The same principle applied to the ex-meridian problem gives the result that the reduction is equal to the rate of change of altitude per half-minute of time, multiplied by the number of minutes of time from the meridian.

So far from decrying the rapid methods now so needful in practice, the author advocates their further use. He gives a "Method of solving the Ex-meridian Problem practically by the Azimuth Tables," which are, or should be, in the hands of every navigator, and also "Practical Rules for finding Time of Maximum Altitude," and ends with "Application of the Azimuth Tables to other Problems."

We can heartily recommend this short contribution to the science of nautical astronomy in its application to the practical requirements of modern navigation.

PERFUMERY.

Odorographia: a Natural History of Raw Materials and Drugs used in the Perfume Industry, including the Aromatics used in flavouring. Intended for the use of Growers, Manufacturers, and Consumers. By J. Ch. Sawer, F.L.S. Second Series. (London: Gurney and Jackson, 1894.)

THIS book is a continuation of the subject of odour-yielding products treated of by Mr. Sawer in a volume bearing the same title and issued in 1892. Though the present book is a companion volume in every respect to its predecessor, and might well have been designated as the second volume, the author has preferred to call it the second series, thus implying, and indeed distinguishing, the former book as the first series—a little peculiarity which does not in itself affect the value of the work, but which tends to confusion lest the second series might be taken for an extended or enlarged edition of the first; whereas the term volume would have implied that it is an entirely new book, which is really what the author wishes his readers to understand, as he tells us in the preface to the new

volume that the matter treated therein is a "continuation of the subjects already discussed."

It is true that many perfume-yielding plants treated of in the first volume are again referred to in the second. Mr. Sawer says that the matter published by him two years ago is now as far as possible brought up to date. This may be so, so far as the chemistry of the various substances is concerned; but we scarcely think, as an instance, that the paragraph on Ambrette (p. 402) indicates any new discovery since 1892, when *Hibiscus Abelmoschus* was briefly referred to and sufficiently described. The following is the paragraph to which we refer. It is placed in Section iv. under the head of "Addenda to Volume i." :—

"Ambrette, the seeds of *Hibiscus Abelmoschus* (Lin. Spec. 980).—'Hibiscus' is one of the names given by the Greeks to 'Mallow,' and is said to be derived from *Ibis*, a Stork, a bird which is said to chew some of the species. 'Abelmoschus' is derived from the Arabic *Kabb-el-Misk*, 'grain or seed of musk.' The 'Mallow' group consists of a very large genus of *Malvaceæ*, characterised by their large showy flowers being borne singly upon stalks towards the ends of the branches, by having an outer calyx or involucel composed of numerous leaves, and an inner or true calyx cut into five divisions at the top, which does not fall away after flowering; by having five petals broad at top and narrow towards the base, where they unite with the tube of the stamens; and by the latter forming a sheath round the five-branched style and emitting filaments bearing kidney-shaped anthers throughout the greater part of its length. The fruit is five-celled, with numerous seeds. *Hibiscus Abelmoschus* is a shrub of 6 to 8 feet in height, native of the East Indies and South America. Its leaves are somewhat peltate, cordate, 5 to 7-angled, acuminated, serrated, stem hispid; pedicels usually longer than the petioles; involucel 8 to 9-leaved. Flowers sulphur-coloured with a dark blue centre. Capsules conicle (*sic*) covered with bristles. The seeds are large and have a very musky odour. The seeds yield on distillation 0·1 to 0·25 per cent. of essential oil, which congeals at + 10° C. Its sp. gr. at 25° C. is 0·900 to 0·905."

It will scarcely be conceded that the bulk of this paragraph brings the information on Ambrette up to any more recent a date than might have been given in the book issued two years ago, for the botanical description is acknowledged as having been obtained from such works as Rumphius' "Herbarium Amboinense," Rheede's "Hortus Malabaricus," &c. The descriptions, indeed, of this and of most other plants referred to is of little or no value in a book of this character, and only helps to increase its bulk, a thing to be avoided in a work "intended for the use of growers, manufacturers, and consumers."

The range of plants over which Mr. Sawer travels is very extensive, and is indicated by the five and half pages of works consulted, as well as by a casual glance through the pages of the book. Many of these plants are new to us as perfume yielding.

The three species of *Barosma*, for instance, namely *B. crenulata*, *B. betulina* (which, by the way, is spelt Barasma), and *B. serratifolia*, the leaves of which are well known in pharmacy under the name of Buchu leaves, seem as much out of place in a work on perfumes as asafœtida or castor oil would be; and the fact that the leaves of the Barosmas "are used by the Hottentots as perfumes," is but a slight recommendation for their adoption in civilised life. Notwithstanding that Mr. Sawer summarises rather fully what has been done by such well-known chemists as Prof. Flückiger, Messrs. Schimmel, and others, in the examination of Buchu oil, he does not inform us whether the oil has been actually used in perfumery, or whether there is any prospect of its becoming an article of the perfumer's trade. All we gather on this point is that its odour agrees with that of peppermint.

Regarding the arrangement of the plants or products referred to in the book, we cannot discover that any systematic method has been attempted; the plants are not classed scientifically nor alphabetically, and if it were not for a fairly extensive index a good deal of difficulty would be experienced in finding any particular plant required. It cannot be denied that the book contains an immense amount of useful and interesting matter, and exhibits an enormous labour expended in its compilation. With a good deal of judicious pruning, a systematic classification of subjects, and much careful editing, the two books might be reduced into one good-sized volume, and made a standard work on all matters relating to perfumery.

That a careful revision has not been made of the proof sheets, is evident from the frequent mis-spelling both of scientific and common words. Thus we find *Melliaceæ* for *Meliaceæ*, String Bark for Stringy Bark, *Stellingia sabifera* for *Stillingia sebifera*, Madagasca for Madagascar, and such like errors that might with ordinary care have been avoided.

OUR BOOK SHELF.

Introduction to Elementary Practical Biology. By C. W. Dodge, Professor of Biology in the University of Rochester, U.S.A. (New York: Harper and Brothers, 1894.)

THIS volume of 422 pp. octavo is the first laboratory book on the established lines of Huxley and Martin's "Elementary Biology" which has reached us from the New World. It, however, excels that in scope, owing to the introduction of additional types of both plants and animals—the Starfish, Locust, Sponges, Rockweed (*Fucus*), Liverwort, and Water-silk (*Spirogyra*) being among those dealt with. The work embodies the results of seven years' experience in practical teaching; but, that notwithstanding, it bears at every turn the impress of the recognised English treatises of its kind, and to these the author, unlike certain writers nearer home, manfully acknowledges his indebtedness. The book opens with an introduction, dealing with instruction in manipulation and the use of instruments, and closes with an appendix, giving lists of and recipes for reagents, and there are added a bibliography of works of reference and a very good glossary-index. The bulk of the volume is subdivided into three parts dealing in succession with the Biology (1) of the Cell, (2) of the Animal, and (3) of the Plant, elementary experimental physiology and the study of habit receiving adequate attention. Such novelty as is claimed for the work is born of its author's conviction that "the methods of teaching now in vogue for elementary classes are methods of *instruction* rather than of *education*" (!) and he sets himself to overcome this imaginary defect of what he terms the "verification method" by the introduction of questions, as opposed to the more diadactic statement of facts customarily resorted to. Up to a certain point this may be all very well. For example, in dealing with

the Protozoa, with which and the analysis of simple cell structure the author's course commences, the student, being told how to capture and mount his sample, is asked, "How many different shapes can you distinguish?" "What variations in size?" "In color?" and other questions of like order; but when there follow these (on p. 5 of the work), "How do these animals eat?" "Digest their food?" "Breathe?" (*sic*) we confess to a feeling of sympathy with the befuddled beginner. And when, further, after an altogether insufficient preamble and at the outset of his inquiry into the wide domain of biology, the tyro is asked, of the Amœba, "Is the process [of fission] preceded by sexual union?" "How is one sex distinguished from the other?" and, *à propos* of the cerebral hemispheres of the frog, "Why are they called hemispheres?" one's sympathy gives place to pity for the student thus led astray. We entirely disagree with the author's dictum that sooner or later the student will have to learn to use the microscope, and it matters little when he does so; and we further doubt the advisability of his interrogatory method, when "the questions usually apply equally well to several related forms," particular species being said to be "not required." A training in elementary biology is one in manipulation in a field beset with snares and pitfalls, rendering it a primary necessity to teach the beginner what to leave unconsidered. However, the experiment, while not altogether new, is an interesting one; the book is carefully compiled, and we await with interest the verdict of time upon the system which it advocates.

Notes on the Ventilation and Warming of Houses, Churches, Schools, and other Buildings. By the late Ernest H. Jacob, M.A., M.D. (London: S.P.C.K., 1894)

A MELANCHOLY interest is attached to this little manual of health in the fact that its gifted author passed away on March 1. His posthumous work shows what a promising life was cut short, and will serve as a memorial to him. The idea that human beings confined in public buildings should have pure air at a suitable temperature supplied them, has only in recent years been taken seriously. It is notorious that in most churches there is no attempt at proper ventilation, and they are only excelled, as far as disregard for the laws of health go, by many Nonconformist chapels with galleries, and mission-rooms created by knocking two cottages into one. Dr. Jacob's manual should be consulted by those who are responsible for such buildings. Therein they will find described the general principles by which buildings are rendered healthy. The book should also be read by the householder, for he will learn from it how an ordinary dwelling-house ought to be ventilated and better, will find that it is an easy and not very costly business to make the average English house less stuffy and more healthy than it usually is. Indeed, all who desire in a popular form information on the subject of ventilation, should procure this book, while architects and builders would benefit the community by taking its lessons to mind.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

Rotating Shafts.

IN your account (NATURE, May 10, p. 43) of Dr. J. Hopkinson's "James Forrest" lecture at the Institution of Civil Engineers, appears the following statement: "Another example, having a certain degree of similarity with the case of struts, is that of a shaft running at a high number of revolutions per minute, and with a *substantial* distance between its bearings. . . . How will the shaft behave itself in regard to centrifrugal force as the speed increases? *In this case, so long as the shaft remains absolutely straight it will not tend to be in any way affected by the centrifugal force*, but suppose the shaft becomes slightly bent, it is obvious to anyone that if the speed be enormously high this bending will increase, and go on increasing until the shaft breaks. In this case also we may use mathematical treatment; we find that the condition of the shaft is expressed by a differential equation of the fourth order, and from consideration of the solution of this equation we can say that if the speed of any particular shaft be less than a certain critical speed, the shaft will tend to straighten itself if it be momentarily bent, but that, on the other hand, if the speed exceeds this critical value, the bending will tend to increase with the probable destruction of the shaft." (The italics are mine.)

The italicised statement seems to imply that a certain operating cause may have absolutely no effect, which cannot of course be the meaning Dr. Hopkinson intended to convey. Most engineers, it is to be hoped, are aware that the natural tendency of the material of the shaft is to retire from the axis of rotation, and that this is *necessarily* associated with a state of strain and stress throughout the shaft, whether straight or bent, for all speeds of rotation. Dr. Hopkinson must, I think, have had his mind so fully occupied with the idea of rupture through instability, worked out by Prof. Greenhill,[1] that he overlooked the fact that his language suggests the non-existence of the more commonplace and essential elastic phenomena.

So far even as rupture is concerned, Dr. Hopkinson's statements are, I believe, incomplete. The ordinary strain and stress developed by rotation in a shaft may, as I have shown elsewhere,[2] exceed the limits of safety before a velocity is attained at which, on the Greenhill theory, instability becomes possible. This is the more likely to happen the shorter the cylinder and the thinner its walls, if it be hollow; but even in a solid iron cylinder of length eight or nine times its diameter——a very substantial distance in a thick cylinder—the strain developed would be such as to merit an engineer's careful attention before a critical velocity was reached associated with instability.

I am somewhat doubtful whether Dr. Hopkinson's remarks on instability itself are altogether satisfactory. On the mathematical theory there appear in reality to be a series[3] of critical values, if any, at which instability *may* occur. Supposing the velocity gradually raised, it seems possible, *theoretically*, for the shaft to safely surmount the first crisis. It then would appear to remain unexposed to instability until the approach of the next higher critical velocity, and so on.

As Dr. Hopkinson says, Prof. Greenhill's instability theory leads to a differential equation of the fourth order. The solution of this equation is, however, dominated by the terminal conditions[4], at the ends or bearings of the shaft, and unless these be correctly assigned the numerical results deduced from the theory are untrustworthy. This is, I think, one of those points where the practical experience of the engineer is a most essential auxiliary to the analysis of the mathematician.

Kew Observatory, May 11. CHARLES CHREE.

IN order to shut out every possibility of ambiguity, I might have said, instead of "substantial distance between the bearings," "distance between the bearings very great in comparison with the diameter of the shaft," and in the next sentence quoted it would perhaps have been clearer if I had said "will not be broken by centrifugal force." But I do not think that in fact I could be misunderstood by anyone.

It was hardly desirable that I should touch upon the terminal conditions, or upon the possibility of stability between the critical values, in a paragraph introduced for illustration and not for detailed information.

But Mr. Chree's letter does remind me that I neglected to refer to Prof. Greenhill's name in this connection. This I should have done with the greatest pleasure, but, unfortunately, for the moment I forgot that it was he who had worked on the problem. I write this note in order to make the acknowledgment. J. HOPKINSON.

[1] Institution of Mechanical Engineers, *Proceedings*, 1883, pp. 182-209.
[2] Camb. Phil. Soc. *Proceedings*, Feb. 8, 1892, pp. 283 *et seq.*
[3] See *Phil. Mag.* August 1892, pp. 166-67.
[4] See Camb. Phil. Soc. *Proceedings*, *l.c.* p. 300, and *Phil. Mag. l.c.* pp. 164-65.

The North Sea Ice Sheet.

IN his letter in NATURE, May 3 (p. 5), my friend Prof. Hughes calls attention to a most important fact. In archæology it has long been known how necessary it is to make sure that not only the exact *provénance* of an object is ascertained, but also that when found it was *in situ*, and was not the result of a later disturbance of the ground. Thus Mr. Franks has a pricket candlestick, made at Limoges, which was found several feet deep in gravel at Calcutta, and this strange fact was only explained when it was discovered that the gravel in question was ballast, which had been dredged from the Thames, deposited in the hold of a vessel, and redeposited at Calcutta. The same caution is more especially needed in geology. Prof. Hughes describes the foreign ballast which he saw stranded on our east coast, and warns us of the very wrong inferences that may be deduced from it. I would add to his statement that it was the custom of the old Danish pirates to use blocks of stone as anchors, and thus no doubt some foreign boulders have found their way to the east coast of Britain.

Here we seem to have an explanation of the occurrence of so-called Norwegian boulders on the Yorkshire coast between Hull and Scarborough and at Cleethorpes, and which, oddly enough, are not found in Scotland, though so much nearer Scandinavia.

It must be remembered that the mother rocks from which these Scandinavian boulders are supposed to have been detached do not occur on the western flanks of the Norwegian mountains at all. In this behalf I will quote Mr. Carvell Williams, himself a believer in some ultra-glacial views. He describes these boulders as consisting of the "typical augite syenite, which occurs only at Langesund Fiord, near Breng, and also porphyry and granite from the same region. *All of these rocks*, he says, came out of the Skagar Rack, and were brought by a glacier going south from Christiania and then south-west. Other rocks came from Fredericksvorn on the same coast."

This is assuredly a very difficult journey to understand. If the North Sea, as we are told, was filled with ice, how could an ice stream force its way from the comparatively low country round the Christiania Fiord right round the Nose of Norway, and then across the deep ocean basin to Britain? Prof. Bonney has argued that any ice sheet would be embayed in the great trough which skirts the coasts of Norway, out of which it could not rise again. Apart from this, it must be remembered that if the elevation of this ice sheet was so slight at the point when it started its journey as to enable it to get a load of these Norwegian boulders on its back from the comparatively low ground where the mother rock occurs *in situ*, it could not have the necessary slope to move beyond a very short distance. Pettersen has shown very admirably that the glaciers from the high mountains of Northern Norway, far from traversing the North Sea, were not powerful enough even to reach the string of islands which line the western shores of Norway, *a fortiori* would this capacity be lacking in the case of the ice from Christiania Fiord. The existence of the serrated and peaked Lofoden islands in the route which a North Sea ice sheet must have traversed was long ago pointed out as a great impediment in the way of such a postulate. Again, if this vast ice sheet came from any part of Norway, how did it get the stones on to its back? for in that case all Norway must have been smothered with ice. Lastly, where is the terminal moraine, or anything like a moraine, left by this monster? A glacier is not like a river which deposits fewer and fewer stones from its head waters as it flows. On the contrary, a glacier deposits its greatest load at its furthest extremity. In the case in question we have a few sporadic stones only, whose origin may well have been such as that pointed out by Prof. Hughes. It seems to some of us, and I have argued the question in my "Glacial Nightmare," that the whole notion of a North Sea ice sheet is a product of some other form of reasoning than inductive science, and that we have no good reason to doubt that when the mountains of Scotland and Scandinavia were nursing large glaciers, the North Sea was free from ice, except perhaps some floating bergs, and was the home of a rich molluscan fauna.

HENRY H. HOWORTH.

Festoon Cumulus or "Pocky" Cloud.

THE following observation of Dr. Clouston's "pocky" cloud, which I had an opportunity of making a few days ago during a sounding cruise on board H.M.S. *Jackal*, seems to throw some light on the conditions under which this somewhat rare phenomenon occurs in these islands.

At 9.30 a.m. on May 3, while sounding in lat. 59° 45′ and long. 1° 20′ W., wind west-south-west, force 3 to 5, very gusty, a heavy squall approached from windward and struck the ship; wind in the squall about north, maximum force 8 to 9. Similar squalls came up at intervals during the day, the weather remaining almost unchanged except for a slight veering of the wind in the afternoon and the appearance of a "mackerel sky" of unusually fine texture.

While sounding in lat. 59° 32′ N., long. 1° 0′ E., a squall similar to the others approached from windward (west), and reached the ship at 6.20 p.m. The wind again shifted some points to the northward, with a smart shower of rain and sleet. Ten minutes later the "pocky" cloud was observed, forming the rear of the squall cloud. The number of festoons or mammæ was eight, with a possible ninth, of which two were incomplete, looking as if the bottom had come out of the "poke." The appearance fully maintained its reputation as a prognostic. The wind shifted to north-west about 9 p.m., and at midnight it was blowing a whole gale from that direction.

Before the "pocky" cloud was observed my attention was specially drawn to the weather by the peculiar nature of the sea disturbance. A moderate swell from windward appeared to be complicated by a cross sea from about north-east, resulting in a kind of miniature of the pyramidal seas met with in the centre of tropical cyclones. When the gale broke out the sea produced in this way tried the *Jackal* to an extent out of all proportion to the violence of the wind. It would appear from the "Daily Weather Reports" that at the time the "pocky" cloud was seen the *Jackal* was slightly in advance and to the right of the centre of a depression which had shortly before begun to increase in depth. If the cloud was observed in a region where an ascending current was increasing in velocity, its indications are of obvious interest. In any case, Abercromby's statement ("Weather," p. 79), that the storm the festoons prognosticate belong to another cyclone following, requires modification.

Oxford, May 10. H. N. DICKSON.

Ouramœba.

THIS peculiar amœboid animal was first observed by the late Dr. Jos. Leidy in 1874. Though he recognised in it the essential characters of the genus *Amœba*, the permanent filamentous appendages with which the posterior end of the body is provided led him to consider it a distinct genus. His description, embodied in "Freshwater Rhizopods of North America," was published by the United States Government in 1879, a brief notice of the form having appeared previously in the *Proceedings* of the Academy of Natural Sciences of Philadelphia. Dr. Leidy cites two or more notices of the same animal by Mr. Archer, of Dublin, who, however, held it to be a form of Wallich's *Amœba villosa*.

In 1879 it was stated by Leidy to be rare, he having found it only in two localities on a single stream in Pennsylvania; but Dr. Stokes, of Trenton, N.J., informs me that it is somewhat common in that vicinity.

My own observations, made in February and March of the present year, upon the only specimens which I have met in this locality, convince me that a suspicion which Dr. Leidy expresses, but which he rejects, is, after all, well grounded, namely, that the filaments, which constitute the only peculiarity of the creature, are of the nature of a parasitic fungus growing upon the genus *Amœba*.

The citation by any reader of NATURE of published observations upon this singular form since Leidy's monograph would be prized by me.

WM. L. POTEAT.

Wake Forest College, N.C.

An Intelligence of the Frog.

DR. ROMANES, in his "Animal Intelligence," p. 254, says that, "frogs seem to have definite ideas of locality." This matter appears to have been noticed of old by the Japanese and Chinese, inasmuch as we credit Ryōan Terashima's explanation of the names given to the frog by the two nations. In his "Illustrated Encyclopædia of Three Systems of Japan and China," completed in 1713 (new edition, Tokio, 1884, book liv. p. 553), he remarks:—"When frogs are 'removed far' (Chinese, *kia*), they always 'long' (Chinese, *mê*) after the original locality; hence the Chinese name 'Hia-má.' For the similar reason the Japanese call them 'Kaeru' (meaning 'return')." Shisei Tagawa (1707–76), one of the most erudite lexicographers of Japan, holds to the same opinion in his "Dust from a Sawyer's Workshop" (Tokio, 1891, p. 8).

May 12. KUMAGUSU MINAKATA.

PERENNIAL IRRIGATION IN EGYPT.

THE "Report on perennial irrigation and flood protection for Egypt," by Mr. Willcocks, brings us face to face with one of the most stupendous applications of science of modern times, and it is to be regretted that in consequence of the tardy arrival of the report and plans in this country, and of the general interest having been directed to a side issue, both the vastness of the scheme and the completeness and admirable method of the preliminary studies have received scant recognition.

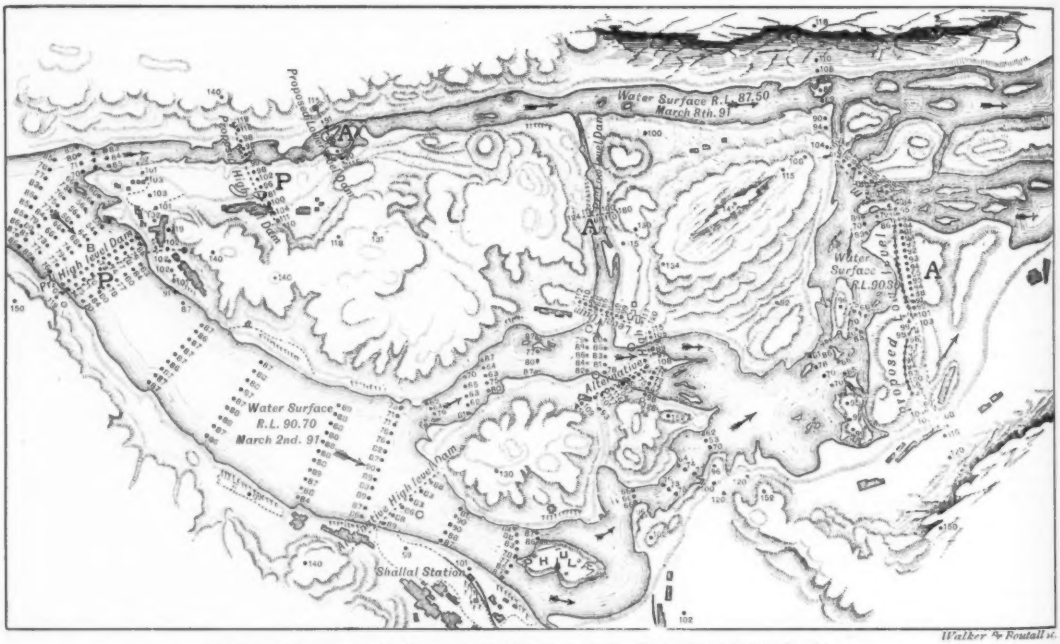
Everybody is familiar with the saying of Herodotus that Egypt is the gift of the Nile, but only few are familiar with the conditions of the river, which are thus tersely stated in one of the appendices to the report. "The Nile drains nearly the whole of North-Eastern Africa, an area comprising 3,110,000 square kilometres. Its main tributary, the White Nile, has its sources to the south of Lake Victoria, and has traversed over 3500 kilometres before it is joined by the Blue Nile at Khartoum. From the junction onwards the river is known as the Nile, and after a further course of 3000 kilometres flows into the Mediterranean Sea by the Rosetta and Damietta mouths. The modulus of the Nile at Assuân is 2990 cubic metres per second, and at Cairo 2610 cubic metres per second."

The total mean annual rainfall in the Nile valley, including the desert north of Khartoum, amounts to 2,633,000,000,000 cubic metres. This water is brought to the main stream by the White Nile in a pretty constant quantity all the year round, but the river is liable to an annual flood which is due to the Saubat, the Blue Nile and the Atbara. Leaving out of consideration the accidents of the river above Assuân, we may state that at that place is the last of a series of cataracts, and also is a gauge by which the various heights of the river at different times of the year and in different years are recorded. The gauges are in metres, and are referred to mean low water level as zero. The zero at Assuân is 85 metres above the level of the Mediterranean.

Taking the years since 1873 the mean of the minimums (which vary between May 14 and June 24) was −0·08 of the gauge; the mean of the maximums (which vary between August 20 and October 1) is 8·17. The Nile flood level at Assuân is then roughly 27 feet above average low water. The water therefore passing over the cataract varies enormously in quantity at low and high Nile; we have in an average of 20 years 440 cubic metres per second in May, 9170 in September.

Finally, of all this water which passes Assuân in such varying quantities at different times of the year, the total yearly average quantity being equal to 2990 cubic metres per second, 370 disappear before Cairo is reached, where the discharge is 2610 cubic metres per second; of this again 550 cubic metres are absorbed for the irrigation of Lower Egypt, so that 2060 cubic metres reach the sea each second, or 65,000,000,000 each year.

The rainfall as stated, treated as it is in Egypt at the present day, gives us the land area under cultivation, the number of crops per annum, and the quantity of produce on which the revenues of the country, and the food of the inhabitants, depend.



The Front Cataract at Assuân, showing the Dams proposed. P P, Philæ; A A A, Assuân.

The question which has occupied the Egyptian engineers of late years has not been whether waste lands can be brought into cultivation and the agricultural yield increased if there were more water—that has long been obvious—but *how much* water was wanted in the worst years. Other questions were, whether the amount was available in the river, and at what period. First as to the amount wanted:—

		Area in feddans.[1]	Water wanted in cubic metres.
Upper Egypt	Assuân to Assyût	1,200,000	1,160,000,000
Middle Egypt	Assyût to Cairo	1,200,000	950,000,000
Lower Egypt	Cairo to Sea	2,810,000	1,551,500,000

[1] A feddan = $\frac{4200}{4047}$ of an acre.

The water requirement, then, is 3,661,000,000 cubic metres. We have already seen that 65,000,000,000 reach the sea each year. But it is not enough to know this yearly amount, we require to know the amount available *after the flood* each year. Taking the worst, Mr. Willcocks shows that the quantity available for storage in November, December, and January amounts to 6,100,000,000 cubic metres, practically twice the quantity wanted.

Next the water has to be stored *above* the place where it is wanted. Since the southern boundary of Egypt is below the second cataract that is out of the question; the only three possible sites for the dam are at Kalabsheh, Assuân, and Silsila. And now a very important question comes in: the slope of the Nile, except at the cataracts, is so gradual that holding up water to any height by a dam will flood a long reach of the river valley up stream of the dam. The dam must be high to store a sufficient amount of water, and naturally the higher the dam the longer will be the flooded region. Thus a dam at Silsila submerges the whole valley to the first cataract including the town of Assuân. A dam at Assuân floods the valley up to Korosko (199 kilometres); a dam at Kalabsheh floods the valley still further south.

It is to be gathered from Mr. Willcocks' report, and Mr. Garstin's (the Under-Secretary) note upon it, and the recommendation of the Technical Commission, the English and Italian members of which were Sir B. Baker and Signor Torricelli, that the Assuân site is the best. The foundations of the dam can be built in the dry and on hard igneous rock. The estimated cost of the dam is a little over £1,600,000.

The proposed dam is thus described by Mr. Willcocks: "The design for the work consists of a solid unsubmergible dam pierced with 100 undersluices 10 m. × 2 m., and constructed on solid rock. The piers between the undersluices are 3 metres wide, and every set of ten sluices is separated from the next by abutment piers 10 metres in width." The undersluices are regulated by Stoney's patent balanced roller gates.

The dam will be worked as follows: During the flood all the sluices will be open, and the flood waters, with all their contained fertilising mud, will be discharged through the undersluices. When the flood has passed, and the comparatively clear water supply has begun to flow, the lower undersluices will be gradually closed so that the water will begin to rise and flow through the higher sluices. When the water has risen to a height 3 or 4 metres above the floors of the higher sluices, or 10 or 11 above the floors of the lower ones, the latter will be entirely closed, and the river will discharge through the upper sluices, which will be gradually closed until the water gains its full level.

When the reservoir is emptied the reverse process will be followed; the higher sluices will be opened first, and then the lower ones, until the time is reached when the next annual flood is due.

It is next of importance to see how this stupendous scheme bears upon Egypt financially. It is pointed out that the value of the reclaimed lands may be estimated roughly at £46,000,000, the increase in the value of yearly rental at £3,700,000, and of the yearly produce £12,000,000.

It will be perfectly clear that if only half of these values are realised the scheme will work wonders for the prosperity of Egypt, and that it would be a crime not to go on with it.

Rests then the great drawback, that wherever the dam is erected a portion of the up-stream valley will be swamped. All the world has heard of the possible drowning of Philæ provided the dam be built at Assuân. But this cry could scarcely have been started by archæologists, for as a matter of fact Philæ is only one temple site out of very many lying between Assuân and Korosko. Since none of them have been completely explored, it is hazardous to state that it transcends the others in scientific importance, although certainly it is uneclipsed as a beautiful spot.

The ruins besides Philæ threatened with destruction have thus been stated by Mr. Somers Clarke in a letter to the Society of Antiquaries:—

"The dam will create a reservoir of enormous extent, not only drowning the island of Philæ, but extending southward into Nubia for nearly a hundred miles. When full the waters of the reservoir will rise several feet above the highest level of the pylon of the Temple of Isis at Philæ. The rocks surrounding the island are full of hieroglyphic inscription; these will spend many months under water, and there is yet much to be discovered in the immediate neighbourhood. At Debôt is a Ptolemaic temple, which retains its original girdle-wall, three great standing doorways, the first being the entrance through the girdle-wall, the second being the doorway in a ruined pylon, and the third standing more immediately before the temple. At Dimri are the remains of ancient structures still to be explored. At Kertassi there is, in fair preservation, a small hypæthral temple with Hathor-headed columns; a little south are extensive quarries, part of the surfaces covered with graffiti, chiefly Greek votive inscriptions. Surrounding the village of Kertassi is a great wall enclosure. At Tafeh a small temple, very perfect, is still standing in the middle of the village, and near it are some remarkably interesting specimens of Roman masonry, but built in the Egyptian manner. They are the lower parts of houses, rectangular structures with their internal subdivisions still to be traced. At Kalabsheh is the most magnificent structure in Lower Nubia. Overhanging the Nile are the remains of a grand quay pierced by two stairways leading on to a great platform. On this is a long terrace of approach from which we rise to another terrace, parallel with the course of the river and lying in front of the pylon. The walls of the temple are very perfect, the roofs only having fallen in. Surrounding the temple is a girdle-wall of masonry. The entrance court of the temple is full of graffiti of the greatest historic interest, and between the crannies of the fallen masonry can be seen many more now inaccessible. At Abu Hor are ancient remains and a quay standing by the river side; a place that needs careful exploration. At Dendûr are the remains of a temple dating from Roman times. The names of many native gods and princes are carved upon the walls. At Koshtemneh are the ruins of a great brick fort, and in one corner of it are the bases of the temple columns. At Dakkeh is a particularity interesting temple. Stones of an early building of Thothmes III. and Seti I. have been found, but the existing structure was begun under Ergamenes, a native king, and completed under a Roman emperor, presumably Augustus. The pylon is absolutely perfect. This building would be engulfed. At Kobban, opposite Dakkeh, are the remains of a very large rectangular fortress of Egyptian crude brick, some 370 by 350 feet. The remains of a temple of the middle empire can be traced, and outside are the remains of temples of the XIXth dynasty. At Mahârakah are the ruins of a very late temple. Its plan is unique. In addition to the places above mentioned there are traces of buried towns and of tombs in great abundance. The whole of these things will be submerged, and the inhabitants transported I know not where."

It has been stated by some that the destruction of these various memorials of antiquity has been regarded by the Egyptian engineers with absolute indifference. It is only just therefore to print the following extract from Mr. Garstin's note dated December 27, 1893, referring to the Assuân dam:—

"Unfortunately, with every advantage in its favour as to volume of water stored, soundness of foundation, and economy of construction, this site labours under the objection (which I fear may be found insuperable) of having Philæ temple on its up-stream side. No dam could be constructed on the cataract without inundating a great portion of this temple for several months every year. I agree with Colonel Ross that no project, which had this effect, should be admitted, unless it were impossible to find a reservoir site elsewhere. We cannot say that there are no other possible sites. There are Kalabsheh, Philæ, and Gebel Silsila, which are all available, and we cannot therefore claim that if a dam has to be built, it must necessarily be

built at the head of the first cataract, and drown the temple of Philæ.

"Admitting this fact to the full, I still consider the Assuân site to be so superior to any other, that if any means could be found for obviating the difficulty which attaches to this temple, I think the subject well worth the consideration of the Egyptian Government, even although it involved additional cost to the project. On p. 36 of his report, Mr. Willcocks suggests the possibility of removing the temple of Philæ from its present site, taking it up stone by stone, and rebuilding it on the adjacent island of Bigeh, where it would be well above the highest water level of the reservoir. I cannot say whether it would be possible to do this without injury to the temple. If so doing would cause any injury, or alteration of any kind to it, I should recommend the abandonment of the Assuân dam altogether. Any work which caused either partial damage to, or the flooding of this beautiful temple, would be rightly considered by the whole civilised world as an act of barbarism. Moreover, it would be an act not absolutely necessitated by the circumstances, for I repeat that we have other possible, though somewhat inferior, sites upon which to construct dams.

"If the removal of Philæ temple is, however, only a question of expenditure, the subject at once commands attention. In this matter I turn naturally to Mr. T. de Morgan, the able Director of the Department of Antiquities in Egypt. If it is possible to remove the temple, and rebuild it upon the adjacent island exactly as it stands at present, we may rely on his ability to do so; and I ask that his opinion as to the removal and reconstruction of Philæ temple be obtained before the project for the Assuân dam be altogether rejected.

"Were the removal of the temple to be successfully carried out, I cannot myself see that it would be an act of vandalism, which, as I read it, is a term meaning the wanton destruction of interesting relics. In this case there would be no question of wanton destruction. The Government of Egypt would duly weigh on one side, the advantages to the country of the safest and most economical dam which could be constructed north of Wady Halfa, and, on the other, the sentiment which clusters round the site of the present temple, and objects to its removal even if it could be done without injury. Finding the advantages to the country to outweigh the sentiment, it would proceed to carry out the work with a religious regard for every detail, and through the agency of the competent staff of the Department of Antiquities.

"Removals somewhat similar to that now proposed have been successfully carried out. Mr. Willcocks mentions in his report having himself, when at Rome, been a witness to the dismantling and rebuilding of the most ancient existing bridge over the Tiber by Italian engineers. Civilised nations in recent times have removed from their original sites, and set up in other countries, interesting and valuable monuments. The Elgin marbles taken from the Acropolis and deposited in the British Museum, afford an example, and so also do the Luxor obelisk in the Place de la Concorde, and Cleopatra's needle on the Thames Embankment. These records of the past have been removed from their historical surroundings, and set up amongst others with which they are not in keeping. We, on the contrary, prompted by a desire to benefit the country, suggest the removal of an ancient building from one site on the Nile to another which is but a few hundred yards distant. We propose re-erecting it exactly as it stands to-day, and on an island in the middle of the great lake which we hope to create, where it would form a beautiful and appropriate object in the landscape."

To us it seems clear that with such a case as the Egyptian engineers have made out for the increased water supply, it is certain that a dam will be built somewhere, and, to be more precise, unless the frontiers of Egypt are enlarged, between Wady Halfa and Assuân. Assuân, Philæ, and Kalabsheh have each been suggested, and in either case the memorials of antiquity along a long reach of the river will be necessarily destroyed. This being so, there is room for an attempt to carry to a completion the work begun by the French Expedition of 1798, and continued by Lepsius in 1844, by making an English survey of the Nile between Philæ and Wady Halfa. Archæologists associated with engineers in such a work as this would certainly be a more pleasant sight to gods and men than when indulging in charges of "vandalism" and the like; and be it remembered no amount of money voted by Parliament, or by the Egyptian Government, no munificence of archæologists and others, with a view of dealing with the case of Philæ alone, will be of avail in final mitigation if a dam is to be built *anywhere*. To consider Philæ alone would convict us of a philistinism by the side of which the "vandalism" of the engineers were small indeed! On the other hand, when such a survey as that suggested has been completed; when what Maspero has called *l'histoire matérielle* of every temple has been investigated; every inscription copied, and every detail photographed, dam or no dam we shall be infinitely better off from the scientific point of view than we are now or should have been for the next century, if the question of the dam had not been raised.

J. NORMAN LOCKYER.

THE CENTENARY OF THE PARIS POLYTECHNIC SCHOOL.

THE hundredth anniversary of the foundation of the Polytechnic School of Paris was celebrated on the 17th, 18th, and 19th of May.

The 17th, consecrated to the memory of o'd comrades, comprised, in the morning at 10.30, a visit to the tomb of Monge M. Mercadier, Director of studies at the Polytechnic School, pronounced Monge's eulogy, and deputations from the Institute, &c., assisted him. At 2.30 the President of the Republic visited the school and examined the pupils. M. Faye made a speech recalling different events of the school. Then a tablet was put up to the memory of the comrades killed by the enemy a century ago. The 18th was the "cérémonie des ombres." Lastly the *fête*, which took place on the 19th at the Palais de Trocadéro, constituted, independently of its programme, a special attraction, as *fêtes* had never previously been given at night in the immense and magnificent hall. From 10 o'clock to midnight more than 5000 people took part in the gala entertainment, which was followed by a ball.

The palace and Trocadéro Park were brilliantly illuminated. The entertainment consisted almost entirely of compositions by old pupils of the school. It ended with an apotheosis by M. A. Silvestre, during which a remarkable picture, consecrated by M. Dupain to the glory of the school, was uncovered.

The eulogy on Monge, pronounced by M. Mercadier, was of great eloquence. Monge was, as a child, very remarkable. When sixteen he made a plan of his native town, having invented an instrument for determining angles. At the age of twenty-two he had already invented many things. With the aid of an engineering officer he got into the Engineering School at Mézières, where in 1768 he succeeded Bossut as professor of mathematics, and two years later, Nollet in a course of physics.

He published his great works on "Les Surfaces considérées d'après leur mode de génération" in the Memoires de l'Academie de Turin. The illustrious Lagrange, after reading them, exclaimed "Avec son application de l'analyse à la représentation des surfaces, ce diable d'homme sera immortel!" "Ce diable d'homme" was but twenty-five, but—true to prophecy—made himself immortal.

In 1780 Monge was made professor of hydraulics; at the same time he entered the Academy of Sciences in the mechanical section. He lived six months in Paris, then six months at Mézières, but in 1783, on being made naval examiner, he returned to Paris for good.

He was an ardent revolutionist, and was made Minister of that department in 1792, during which time he unconsciously made a true friend of Buonaparte. In 1794 he helped to found the school in which he was a devoted professor.

In 1796 he and Berthollet and a few artists were ordered to Italy, to collect the numerous objects of art handed over to France by various Italian towns. It was at this time he became great friends with Buonaparte and Berthollet. Afterwards he took part in the Egyptian Expedition. He went with Berthollet, and Berthier in his report says of them: "ils s' occupent de tout et sont partout."

On his return to France, Monge again devoted himself to the Polytechnic School, his affection for the pupils and influence with them being unchanged and quite remarkable. After having worked steadily for forty-five years, he was obliged, on account of bad health, to retire.

The political disturbances, in which he was much engrossed, all tended to affect his health, but the disbanding of the school in 1816 was the final blow. He was never the same again, and died July 18, 1818.

M. Mercadier's address ended with a touching appeal to his auditors to imitate the patriotism and emulate the science of the great man whose useful life and work they had met to celebrate.

We may have to say something of the final *fête* next week.

NOTES.

WE learn with profound regret that Dr. Romanes died at Oxford at twelve o'clock yesterday.

THE first meeting of the International Meteorological Committee, as reconstituted at the Munich Conference of 1891, will be held at Upsala, and will commence on August 20. The programme, as will be seen, consists mainly of the various questions referred to the committee by the Conference. (1) Reports of the President and Secretary; (2) the question of the establishment of an International Meteorological Bureau; (3) Agricultural Meteorology; (4) the establishment of stations for the observation of the direction and velocity of movements of clouds; (5) the construction of a Cloud Atlas (reports from Dr. Hann, Dr. Hildebrandsson, Mr. Rotch, and M. L. Teisserenc de Bort); (6) the possible acceleration of weather telegrams; (7) the observation of the scintillation of stars (a proposal by M. Charles Dufour); (8) the organisation of the next Conference.

PROF. ROBERTS-AUSTEN is to be congratulated on having completed his responsibility for no less than one hundred millions sterling of gold coin. The twenty-fourth annual report of the Royal Mint, which has just been issued, shows that of the long series of holders of his office none could have claimed anything like such a record, as the largest amount of gold coin for which any individual King's Assay Master had previously been responsible was the fifty-nine millions coined during the tenure of office of Mr. Robert Bingley, King's Assay Master from 1798 to 1835. As showing the remarkable accuracy of the standard fineness of coins, the Mint Report states that of the hundred millions sterling of gold coin, seventy-one millions were sovereigns, and that their average fineness as indicated by successive trials of the Pyx proved to be 916·668. The exact legal standard is 916·666, and it must be remembered that the gold coins would be within the "remedy" allowed by law if the amount of precious metal they contained varied between 914·6 and 918·6 parts in one thousand.

THE preliminary programme of the fourteenth Congress of the Sanitary Institute, to be held in Liverpool in September, has now been issued. The meetings of the Congress will consist of three general addresses and lectures. The three sectional meetings, dealing with (1) Sanitary Science and Preventive Medicine, (2) Engineering and Architecture, (3) Chemistry, Meteorology, and Geology, will be presided over by Dr. E. Klein, F.R.S., Mr. G. F. Deacon, and Dr. Thomas Stevenson. Five special conferences will take place: the Sanitation of the Passenger and Mercantile Marine Service, presided over by Sir W. Bower Forwood; Medical Officers of Health, presided over by Mr. Charles E. Paget; Municipal and County Engineers, presided over by Mr. A. M. Fowler; Sanitary Inspectors, presided over by Mr. Francis Vacher; Domestic Hygiene, presided over by the Lady Mayoress of Liverpool. An exhibition of sanitary apparatus and appliances and articles of domestic use and economy will be held, and excursions to places of interest from the point of view of sanitation will be arranged for those attending the Congress. The local arrangements are in the hands of an influential local committee, presided over by the Lord Mayor of Liverpool, with the City Engineer (Mr. H. Percy Boulnois) and the Medical Officer of Health (Dr. E. W. Hope) as honorary secretaries. It appears from the programme that over 100 sanitary authorities, including several County Councils, have already appointed delegates to the Congress, and as there are 1500 members and associates in the Institute, a large attendance may be expected.

A COMMITTEE has been formed at Boulogne for the purpose of making arrangements for an international exhibition of hygiene and hydropathy, which it is proposed to hold there from July 15 to September 15.

A KNIGHTHOOD has been offered to Dr. J. C. Bucknill, F.R.S., not for his scientific work, but in recognition of his services to the volunteer movement, of which he was the originator. Dr. Bucknill was elected into the Royal Society in 1866, and is now in his seventy-eighth year.

THE thirty-ninth annual exhibition of the Photographic Society of Great Britain will be inaugurated by a conversazione on September 22, and will remain open from Monday, September 24, to November 14. Medals will be awarded for the artistic, scientific, and technical excellence of photographs, lantern slides, and transparencies, and also for apparatus. Foreign exhibitors are invited to contribute. The Society will pay the carriage of photographs on the return journey, and provide frames or portfolios during the exhibition for approved photographs. There will be no charge for space. Communications on all matters connected with the exhibition should be sent to the Secretary of the Society, 50 Great Russell Street, Bloomsbury, W.C.

ALL students of science know that a knowledge of German is essential in their work, and no better way of obtaining it can be found than by joining German students in study. Facilities for obtaining this desirable end are now offered in the shape of holiday courses at Jena, from August 1 to 23. The courses have been arranged by a committee representing some of our University Colleges and High Schools, Mr. J. J. Findlay (Rugby) being the secretary. There will be an elementary course for those who have little or no acquaintance with the spoken language. The subjects dealt with in this course include physiological psychology, the hygiene of schools, and pedagogy. Each will be conducted by an experienced teacher, who will speak very slowly and clearly, but will only employ the German language as the medium of instruction. A more advanced course, for those who can follow lectures delivered in German, will be held from August 1 to 16. During this period Dr. Straubel will lecture every day on the microscope, Prof. Detmer on the fertilisation of plants and microscopic botany, Prof. Schäffer on experimental physics, and Prof. Auerbach on modern physical demonstrations. Dr. Knopf will discourse on time and its determination, illustrating his lecture with practical work at the Observatory; Dr. Straubel will give demonstrations on electrical and magnetic measurements; Prof. Wolff will lecture on theoretical and practical chemistry; Prof. Ziehen on phy-

siological psychology; Dr. Rö ner on zoology; and Dr. Gänge on spectroscopic and polarising apparatus. This programme should be sufficient to tempt many students of science to Jena, and they may be assured that the German schoolmasters, who attend similar summer meetings every year, will offer a cordial welcome to their "englische Kollegen."

THE Friday evening discourse at the Royal Institution, on June 1, will be delivered by Prof. Oliver Lodge, F.R.S. The subject will be "The Work of Hertz." On Tuesday afternoon Dr. Dallinger began a course of three lectures on "The Modern Microscope, an Instrument for Recreation and Research," and to-day Prof. Flinders Petrie commences three Thursday afternoon discourses on "Egyptian Decorative Art."

IT has been decided to provide chambers in one of the light towers which will be erected on either arm at the entrance of Madras Harbour, when finished, for the purpose of a tidal observatory, the establishment of which has been approved of by the Government of India.

PROF. VINCENZ CZERNY, of Heidelberg University, has been elected to fill the chair of Surgery left vacant in Vienna University by the death of Prof. Billroth.

THE Midland Railway Naturalists' Society has been established at Derby. The first monthly meeting was held on Monday, 7th inst.

MISS NORTH'S Gallery of Flower Portraits in Kew Gardens has been reopened to the public, the pictures having undergone a thorough inspection and varnishing, under the advice of the President of the Royal Academy.

IT is reported from Auckland, by Dalziel's Agency, that two shocks of earthquake occurred at Wellington on Monday morning. They were preceded by loud concussions, and all the buildings in the town were violently shaken, the public library being considerably damaged. Lesser shocks were also felt at Nelson, Taranaki, and Christchurch.

DR. GILL, the Director of the Cape Observatory, has communicated to the *Times* some significant facts in connection with the recent earthquake at Thebes. He says that the observer on duty with the transit circle, on the evening of April 27, found that the surface of the mercury used in making observations for errors of level was disturbed by continuous and persistent undulations from 6h. 2m. to 6h. 32m. Greenwich mean time. It was not until 6h. 43m. that the undulations ceased sufficiently to permit good observations of nadir and level to be made. No general conclusion can be drawn from these observations, but Dr. Gill thinks it probable that the delicate disturbances of the mercury at the Cape of Good Hope had its origin in the disturbance which produced such disastrous results at Thebes.

A CONSIDERABLE retrocession of temperature has occurred over these islands during the past week, accompanied by strong northerly and easterly winds, and causing much injury to fruit and vegetable crops. Snow or hail fell over the whole of Scotland and a large part of England and Wales on Sunday, while the minimum shade temperature on Sunday and Monday nights fell several degrees below freezing point, and on the grass temperatures of 20° or less have been recorded. For several days the maximum shade temperature did not exceed 45° at places in Scotland, and was below 50° in many other parts. In the neighbourhood of London it was below 50° on Sunday, a value which is about equal to the average maximum temperature of the middle of March. The Greenwich temperatures show that so low a maximum in the second half of May is very rare, having occurred only twice in the last twenty years.

A "MONOCHROMATIC rainbow" is rare enough to deserve record. Mr. Charles Davison writes:—"On the 28th of last November rain was falling shortly before sunset, and a rainbow was formed, though little more than the nearly vertical portion of one limb was distinctly visible. In a few minutes the blue, green, and yellow parts gradually faded away, and only a dull red band remained."

WE have received several numbers of the *British Central Africa Gazette*, published at Zomba, containing interesting articles on the prevention of the coffee-disease, and on the export of india-rubber (*Landolphia*) from the West Shire, Lower Shire, and Ruo districts.

THE *Naturwissenschaftliche Wochenschrift* for May 13 contains an interesting article, with illustrations, on fossil-like structures produced by the action of running water. Some of them present a remarkable resemblance to algæ and to the leaves of ferns; and the author, Dr. T. Fuchs, questions the organic origin of many so-called fossil remains from the older formations.

IN the form of a rectorial address to the University of Basel, Dr. G. Klebs has published an interesting essay on the relationship of the two sexes in nature. The first development and gradual progress of sexual differentiation in the animal and vegetable kingdoms are traced, and the connection between sexual reproduction and the development of new forms of life is discussed. Dr. Klebs sums up strongly in favour of the theory of the inheritance of acquired characters.

AT a recent meeting of the Société Française de Physique, M. Curie read a paper on the magnetic properties of soft iron at temperatures between 20° and 1350°, and for magnetising forces of 25 to 1350 units. He has drawn a series of curves showing the connection between the magnetising force and the intensity of magnetisation at different temperatures. For magnetising forces up to 1300 units the different curves do not differ much, but for higher values of the magnetising force they separate to a more marked degree. For temperatures between 756° and 1375° the curves obtained are straight lines passing through the origin, showing that between these temperatures the susceptibility is a constant and independent of the magnetising force. The author has also plotted a series of curves connecting the intensity of magnetisation (I) and the temperature, the magnetising force being constant. The value of I is at first constant as the temperature rises, then it diminishes faster and faster till the change becomes most rapid at a temperature of about 745°. Above this temperature the rate of change of I diminishes. Between 950° and 1210° the value of I only diminishes slowly, while at a temperature of 1280° it increases suddenly, and then as the temperature goes on increasing it gradually diminishes. The author finds that at any given temperature the value of I obtained is independent of whether this temperature has been reached by warming the body or by cooling.

AN interesting paper by M. van Aubel, on the electrical resistance of some new alloys, was recently read before the Société Française de Physique. In the first place, the author gave some particulars about a form of steel called kruppine, manufactured by Herr Krupp, at Essen. This alloy has a specific resistance of 84·7 microhms $\left(\frac{cm}{cm^2}\right)$ at 18° C., or of 85·5 if the sample has been heated for several days. The mean coefficient of variation of the resistance with temperature decreases slightly with increase of temperature, but is always nearly equal to + 0·0007. This body, although it has a relatively high specific resistance (that of german silver being 20·76), can be heated to a temperature of 600° C. without change of structure, and can be obtained in the form of wire

or sheet. The author also gave particulars of the experiments made on some nickel alloys manufactured by Messrs. Fleitmann, Witte, and Co., of Schwerte (Westphalia). One of these alloys (marked I_a I_a) has when hard a specific resistance at 20° C. of 50·2 microhms and a temperature co-efficient of − 0·000011, while when soft its specific resistance is 47·1 microhms and its temperature co-efficient + 0·000005. This alloy may prove of considerable practical utility, although if it is found that its thermoelectric power with reference to copper and brass is, as is generally the case with these alloys, at all great, this will in a great measure prohibit its use in cases where great accuracy is required. During the discussion on the above paper M. Guillaume mentioned that an alloy of 68·6 parts copper, 30 parts manganese, and 1·3 parts of iron has a specific resistance of 108 microhms, while its temperature co-efficient is very small, even passing from positive to negative as the temperature rises. He also mentioned that the difficulty of the high thermoelectric power with reference to copper could be overcome if the wires are soldered to plates of the same alloy, which are in turn soldered to the copper connectors of the resistance boxes or Wheatstone bridges.

PROFS. RICCÒ AND SAIJA have, after many laborious efforts, succeeded in obtaining a fairly accurate record of the diurnal and annual variations of temperature on the summit of Mount Etna. The results, as communicated to the *Accademia Gioenia di Catania*, form a valuable addition to meteorological thermometry. The impossibility of maintaining a staff at an elevation of 3000 m. above sea-level, at a place difficult to reach and without telegraphic communication, made the employment of automatic recording instruments indispensable. A Richard barograph and thermograph were installed at the Etna Observatory, capable of acting for forty days without further attention. Some interruptions occurred owing to the freezing of the lubricants and irregular unrolling of the register paper, but between August 27, 1891, and February 28, 1894, a total of 357 days were registered automatically, and 137 days by personal observation. With the slight diurnal variation, 3-hour intervals were found sufficient. The highest temperature observed was 16° C., on September 2, 1892; the lowest − 10°·3 C., on March 2, 1893. As a rule, the coldest month was January, and the warmest August. The mean diurnal variation was 1°·6 in winter, and 6°·8 in summer. The climate of the summit of Etna, with its mean annual temperature of + 1°·06 C., resembles that of the North Cape or the Brocken. The uniformity of temperature was to be expected after similar observations in the Alps, and the covering of snow, which usually lies from the middle of November till the end of March, serves to keep the diurnal oscillation in winter below 4°·6 C. The changes of temperature during the year are very similar to those observed at the foot of the volcano, but the daily maximum, instead of being several hours after midday, occurs just about noon at the summit, probably owing to the absence of vapour capable of absorbing and storing up the heat of the sun.

LITTLE is known of the interior of the great peninsula of Labrador, that vast territory estimated to contain two hundred and eighty-five thousand square miles. During the last six or seven years, however, several explorers have visited the region, and returned with interesting geographical results. Mr. H. G. Bryant is one of these, and his description of the journey through Labrador to the Grand Falls on the Grand, or Hamilton River, recently published in a *Bulletin* (vol. i. No. 2) of the Geographical Club of Philadelphia, is full of interest. The greater part of the paper, and all the excellent views that illustrate it, originally appeared in the *Century Magazine*. Mr. Bryant set out with Prof. C. A. Kenaston in June 1891, and they reached the Falls on September 2. A mile above the main leap the river is about four hundred yards wide. Four rapids intervene between this point and the Falls. At the first rapid the width of the stream does not exceed one hundred and seventy-five yards, and from thence it rapidly contracts until, just above the escarpment proper, the water rushes between banks not more than fifty yards apart. Below the Falls the river runs for twenty-five miles between vertical cliffs of gneissic rock, which rises in places to a height of four hundred feet. The water falls through a height of about three hundred and twenty feet, and under favourable conditions the roar of the cataract can be heard at a distance of twenty miles. Appended to the paper is a list of plants collected by Prof. Kenaston during the expedition, and also the results of meteorological observations made at various points. The further exploration of the region traversed by Messrs. Bryant and Kenaston would be of great value to geographical science, and might lead to geological discoveries of scientific and commercial importance.

IN order to satisfactorily identify any particular bacillus with that generally associated with cholera, it is necessary to have recourse to animal experiments. For this purpose it has been customary to use guinea-pigs; and Pfeiffer's method is to take about ·0015 grm. of the surface-growth of an agar-agar culture, distribute it in 1 c.c. of sterile broth, and inject it into the peritoneal cavity. The above quantity is usually fatal with characteristic symptoms to an animal of 300–350 grms. weight. This is, however, by no means a simple or easy operation, but so far no other method of proving the virulence of the cholera bacillus has superseded it. In a recent number of the *Centralblatt für Bakteriologie* (vol. xv. 1894, p. 150), Dr. Sabolotny describes some investigations which he has made on the susceptibility of the marmot to Koch's cholera bacillus. The experiments were carried out in the Bacteriological Institute at Odessa, and Sabolotny mentions that these animals are found in large numbers in the south of Russia. When 0·1–0·2 c.c. of a one-day old broth-cholera-culture grown at 37° C. is introduced into the peritoneal cavity of marmots, they die in from 12–18 hours. Of much interest is, however, the discovery that similar quantities of cholera cultures introduced *subcutaneously* also proved fatal to these animals, the bacilli being found in the blood, liver, spleen, and peritoneal fluid. It was also found that they could be infected *per os* without any preliminary treatment with soda and opium, for marmots fed with materials containing small quantities of cholera bacilli died, and the latter were always found in large numbers in the stomach, as well as frequently in the liver and spleen, and also occasionally in the blood. The identification of the cholera bacillus by animal experiment is thus greatly simplified.

THE Committee that controls the operations of the Kew Observatory, and which in February of last year became "The Incorporated Kew Committee of the Royal Society," have issued their report of the work done during 1893. Under experimental work we note that, to estimate the amount and density of fog and mist, the observation of a series of distant objects referred to in the last report were continued. A note is taken of the most distant of the selected objects visible at each observation hour. An analysis of the results for the period May 1892, to December 1893, is at present being carried out. During the thickest fog experienced in 1893, at one of the hours of observation the most distant object visible was only 12 feet off. Twelve watches, designated "non-magnetic watches," were examined during the year, both as to their ordinary time-keeping and also as to their non-magnetic properties, and although the trial to which they were submitted was severe—the movement being tested in an intense magnetic field, both in

vertical and horizontal positions, and gradually approached to and removed from the poles, whilst its behaviour is critically watched—in the majority of cases the watches were found to perform very satisfactorily. Magnetic and meteorological observations were carried on as usual, and sketches of sun-spots were made on 155 days.

IT occurred to us while glancing through the "Mémoires de la Société de Physique et d'Histoire Naturelle" of Geneva, of which the second part of vol. xxxi. was recently received, that the custom of inserting, at the commencement of the volume, the President's *résumé* of the communications to the Society during his year of office, is an admirable one. The present bulky tome contains an address by the late C. de Candolle, in which he surveyed the scientific advances of the Society during 1891, and also a similar retrospect in which M. E. Sarasin reviews the growth of knowledge during 1892. It has been said more than once that the abstracts of papers are frequently superior to the originals, inasmuch as they present in a concise form the tenor of an author's work. But however this may be, it is certain that the plan followed by the Presidents of the Physical Society of Geneva (and also by those of some of our own Societies), viz. that of giving terse descriptions of the investigations communicated to the Society during their respective years of office, considerably facilitates reference, and what is more, it enables a worker to know the gist of a paper without reading through and digesting the original. In addition to the two presidential addresses referred to, the "Mémoires" contain a paper by Prof. J. Brun, on a new species of marine diatoms, fossil and pelagic, illustrated by twelve plates, containing 120 of the author's drawings, 40 microphotographs by Prof. van Heurck, and 80 by M. Otto Müller. The volume also comprises the second part of Prof. Chodat's "Monographia Polygalacearum," illustrated by twenty-three plates, and the fifth of his "Contributions à la Flore des Paraguay." Both of these papers will excite the admiration of systematic botanists.

THE address delivered by Dr. Armstrong, in March last, at the annual general meeting of the Chemical Society, is contained in the May number of the Society's journal.

THE papers set at the examinations of the Royal University of Ireland during 1893 have just been published as a supplement to the University Calendar for that year.

MESSRS. R. FRIEDLANDER AND SON, of Berlin, have sent us Nos. 5-8 of "Naturæ Novitates," containing lists of scientific works recently published.

MESSRS. PERCY LUND AND CO. will shortly publish a work entitled "The Stereoscope and Stereoscopic Photography," translated from the French of F. Drouin.

AN excellent feature of the *American Naturalist* is the classified notes of recent work in all of the natural sciences. Dr. W. S. Bayley, of Colby University, edits the section devoted to mineralogy and petrography. His contributions to the journal under that head, during 1893, have now been collected and published separately, and the pamphlet thus created forms a useful summary of progress.

THE "Year-Book of the Scientific and Learned Societies of Great Britain and Ireland," published by Messrs. C. Griffin and Co., first appeared in 1884, and has been issued annually since then. It is really an extremely useful and convenient handbook of reference. Lists of the papers read during the year are given under the descriptions of the societies to which they were presented, with the dates of the communications. These have been compiled from official sources, and therefore constitute a trustworthy record of the progress of various branches of science. All the papers read before almost every British society are included in the lists, so the "Year-Book" may claim to be recognised as an important assistant in the organisation of scientific literature.

THE advances made in the study of geology since 1878 have rendered the publication of a new edition of the late Sir Andrew Ramsay's well-known manual on "The Physical Geology and Geography of Great Britain" a necessity, if the book is to retain its place. We are glad, therefore, to learn that a new edition (the sixth) has been undertaken by Mr. Horace B. Woodward, of the Geological Survey. The edition, accompanied by a corrected form of the small coloured map which appeared in the fifth edition, will very shortly be issued by Mr. Edward Stanford.

WE have received the second yearly report of the Sonnblick Society, for the year 1893. The Society now numbers 423 ordinary members, and the report shows that the importance of keeping this mountain observatory in thorough efficiency is fully recognised. The height of the summit has been determined by trigonometrical measurement during the year, and was found to be 10,192 feet, which agrees very closely with that found by barometrical measurements by Dr. Hann. In addition to the regular meteorological observations, special attention is paid by the observer, P. Lechner, to observations of atmospherical electricity, and some interesting results have been already obtained. It is found that the electric condition of the earth at the summit remains nearly constant during clear days throughout the year, so that, owing to its height and configuration, it is free from the daily and yearly fluctuations of electricity which are observed on the earth's surface at lower levels. It would be interesting to know whether this has also been observed at other mountain stations. The observations of St. Elmo's Fire have shown the interesting fact that when snow falls in large flakes, the electricity is almost always positive, but when the snow consists of dust-like particles, negative electricity is developed.

A DIRECT method of preparing the methyl and ethyl derivatives of hydroxylamine of the type RHNOH is described by M. Lobry de Bruyn in the current issue of the *Recueil des travaux chimiques du Pays-Bas*. These so-called β-alkylhydroxylamines have only recently been isolated in the pure condition by Kjellin, by an indirect process, although their formation has been demonstrated by several workers. Goldschmidt and Kjellin some time ago showed that they were produced in the decomposition by hydrochloric acid of the esters of nitrobenzaldoxine. E. Hoffmann and Victor Meyer have also shown that when nitro-ethane is reduced by stannous chloride the hydrochloride of β-methylhydroxylamine, $CH_3 . NHOH . HCl$, is produced; and Kirpal has further proved that the reaction is general, that whenever nitroparaffins are reduced to amines intermediate products are formed which reduce Fehling's solution. Dr. Kjellin has more recently resumed the former work which he carried on in collaboration with Dr. Goldschmidt, and has succeeded in isolating the chlorides of the alkyl hydroxylamines from the products of the reaction above referred to. Moreover, by employing a similar process to that which proved so successful in the hands of M. de Bruyn for the isolation of free hydroxylamine, Dr. Kjellin eventually obtained the pure bases themselves. An account of his work was given in these columns at the time (vol. xlix. p. 38). M. de Bruyn now shows that these simple alkyl derivatives of hydroxylamine may be obtained in the pure state directly from the base itself. In his preliminary account of the isolation of the parent base, he stated that upon agitating a very concentrated aqueous solution of hydroxylamine with methyl iodide and a little methyl alcohol, considerable evolution of heat occurs and a crystalline mass separates. On repeating this experi-

ment with 4·1 grams of a 52 per cent. solution of hydroxylamine, 10 grams of methyl iodide (the molecular proportion), and a smaller quantity of methyl alcohol, mixed together in a flask fitted with an upright condenser, the energy of the reaction was found to be sufficiently great to heat the liquid to the point of ebullition, and crystals soon commenced to deposit. Ethyl iodide reacted in a precisely similar manner. The crystals, after draining and washing with a mixture of alcohol and ether, proved to be those of the pure hydriodides of the β-alkyl hydroxylamines. Their aqueous solutions acidulated with nitric acid do not reduce silver nitrate, so that their analysis is easily effected. In this respect they differ from nitric acid solutions of hydroxylamine, which of course at once reduce silver nitrate. They reduce Fehling's solution, however, instantly at the ordinary temperature. It would appear from this mode of preparation that the action of alkyl iodides on hydroxylamine is similar to their action upon ammonia. The salts are perfectly stable up to beyond 200° C. M. de Bruyn shows finally that it is not essential to have at command such concentrated solutions of hydroxylamine as those obtained during the preparation of the solid base. The weak aqueous or alcoholic solutions obtained in the usual manner from hydroxylamine hydrochloride, may equally well be employed; it is only necessary to decompose the solution of the hydrochloride in tepid water with potash, add an equal bulk of methyl alcohol, filter from the precipitated potassium chloride, and at once proceed to agitate with methyl iodide. The only further point of difference is that the liquid should be finally boiled in the flask fitted with upright condenser in order to complete the reaction.

THE additions to the Zoological Society's Gardens during the past week include a Black-eared Marmoset (*Hapale penicillata*) from South-east Brazil, presented by Mr. H. M. Dodington; a Common Peafowl (*Pavo cristatus*) from India, presented by Mrs. Tannenbaum; a Monteiro's Galago (*Galago monteiri*) from West Africa, two Pinche Monkeys (*Midas œdipus*) from New Granada, deposited; a Maholi Galago (*Galago maholi*), two Japanese Deer (*Cervus sika*) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

RECENT OBSERVATIONS OF JUPITER'S SATELLITES.—In the May number of *Astronomy and Astro-Physics*, Dr. E. S. Holden calls attention to some important points in connection with Prof. Barnard's observations of Jupiter's satellites, recently published in that journal and in the *Monthly Notices*. In the first place, the results announced by Prof. W. H. Pickering in 1893 (see NATURE, vol. xlvii. p. 519), with regard to the forms and rotations of these bodies, are not confirmed by Prof. Barnard's observations. Next, Prof. Barnard has found that all the Jovian satellites are spherical, whereas Profs. Schaeberle and Campbell announced in 1891 that Satellite I. was ellipsoidal, with its longest axis directed towards the centre of Jupiter. It was also concluded by these observers that the periods of rotation and revolution of the first satellite were equal; but Prof. Barnard says that his observations lead to a different result. Another point upon which Prof. Barnard's recent observations have thrown light, is the appearance of the first satellite when projected upon Jupiter. It will be remembered that the satellite was seen in transit as a double body in 1890, but Prof. Barnard has shown that the apparent duplicity was due to simple contrasts between bright regions on the planet and two extensive dusky polar caps on the satellite (see NATURE, vol. xlix. p. 300). Other strange appearances of satellites during transit can be explained in a similar manner. Prof. W. H. Pickering has criticised the statement that the assumed belt on the first satellite is a permanent one (*Astr. Nach.* 3229), and says that it certainly did not exist at the time of the opposition of 1892, during the period covered by the Arequipa observations. He points out that, upon his meteoric hypothesis, it is not unlikely that belts should form and then disappear. It is a fairly common belief among astronomers that the satellites of Jupiter can be seen through the planet's limb during occultation. On this point, Prof. Barnard says: "In my mind this [the observation of the transparency of Jupiter's limb] has been due to poor seeing, a poor telescope, or an excited observer. For nearly fifteen years I have observed Jupiter and his satellites, and with telescopes all the way from five inches up to thirty-six inches have tried to see this phenomenon. I have often watched the satellites under first-class seeing with the 12-inch here [Mount Hamilton] at occultation, but have never seen one of them through the limb of Jupiter, though that phenomenon was specially looked for." It will be seen from these points that Jupiter and his satellites still offer a wide field for investigation.

THE MASS OF THE ASTEROIDS.—Mr. B. M. Roszel contributes to the Johns Hopkins *University Circular* for April a preliminary note on the probable mass of the asteroids. He has investigated the secular perturbations to which a ring of matter, such as the asteroids form round the sun, would give rise. The problem divides itself naturally into two parts—(1) to determine the combined mass of the asteroid belt; and (2) knowing the mass, to derive the secular perturbations of the elements of the orbits of certain of the major planets caused by this elliptic ring of matter. If the total number of the asteroids were known, it would only be necessary to determine the most probable mass of one member of the group to derive the combined mass of the whole group. But this is not the case, so Mr. Roszel has contented himself with determining the mass from a study of two hundred and sixteen of the minor planets at present known. The magnitudes of these bodies vary from magnitudes 6 to 15·5, the greater number lying between magnitudes 11 and 12. From photometric observations, Prof. Pickering derived for Vesta a diameter of 319 ± 10 miles. (Prof. Barnard's recent observations only assign the planet a diameter of 237 ± 15 miles). Now the ratio of the total quantities of light reflected by two planets at the same distance from the observer is equal to the ratio of the squares of their diameters. Utilising this fact, Mr. Roszel has been able to determine the volumes of the two hundred and sixteen asteroids referred to in terms of the volume of Vesta. Assuming Pickering's dimensions of Vesta to be correct, it appears that it would take roughly three hundred and ten asteroids of the sixth magnitude, or twelve hundred of the seventh, to equal our moon in volume. And in round numbers the combined volume of a ring of two hundred and sixteen would be only one two-hundredth part of that of our satellite. Assuming a mean density equal to that of Mars, the mass of the zone of asteroids comes out as about one one-hundred and seventieth part of the mass of the moon. From these considerations Mr. Roszel thinks that the probable mass of the entire asteroid belt is somewhere between one-fiftieth and one one-hundredth part of that of our moon.

EPHEMERIS OF GALE'S COMET.—The following ephemeris (for Berlin midnight) is abstracted from one given by Prof. Kreutz in *Astronomische Nachrichten*, Nos. 3227 and 3229:—

	R.A.	Decl.	Brightness.
	h. m. s.	° ′	
May 26 ...	10 44 37 ...	N. 36 11·3 ...	0·80
30 ...	10 57 40 ...	38 10·9 ...	0·60
June 3 ...	11 9 14 ...	39 39·3 ...	0·40
7 ...	11 19 38 ...	40 45·6 ...	0·33
11 ...	11 29 12 ...	41 35·6 ...	0·26
15 ...	11 38 7 ...	42 13·1 ...	0·21
19 ...	11 46 31 ...	42 41·0 ...	0·17
23 ...	11 54 53 ...	43 1·4 ...	0·14

The brightness on April 3 has been taken as unity.

The comet was photographed by the Brothers Henry, at Paris Observatory, on May 5. The photograph was obtained with an exposure of forty minutes, and showed a tail, about four degrees in length, divided, at a short distance from the head, into two branches separated by an angle of about three degrees. The mean direction of the two parts of the tail was very nearly perpendicular to the direction of the comet's motion.

SOME LONDON POLYTECHNIC INSTITUTES.

IT is only in recent years that any attempt has been made to supply the demand for technical education in London. Not so very long ago the question as to whether such education was desirable for the working classes was gravely

discussed; now the necessity is recognised by everyone, and the subject under consideration is the best method of carrying on the work. The commercial world has begun to realise the importance of training workmen on scientific lines; it has been led to see that the encouragement of science means the advance of industry and increase of trade. These lessons were difficult to learn, and, even at the present time, the connection between science and manufactures is not properly understood. But a beginning has been made. London, the city that prides itself upon being the largest and richest in the world, but which until recently ignored the need for technical instruction, has begun to foster the child it had done its best to kill by neglect. A comparison with the educational work carried on in Polytechnics on the continent has served to accentuate the deficiencies of London, and to create a desire to follow the lead there indicated. The awakening was rather abrupt, and it was thought by some that the time lost could be rapidly made up again. But this mistaken idea has now been given up, and it is seen that the only way to improve our arts and industries is by slowly educating the mind and training the hand of the mechanic.

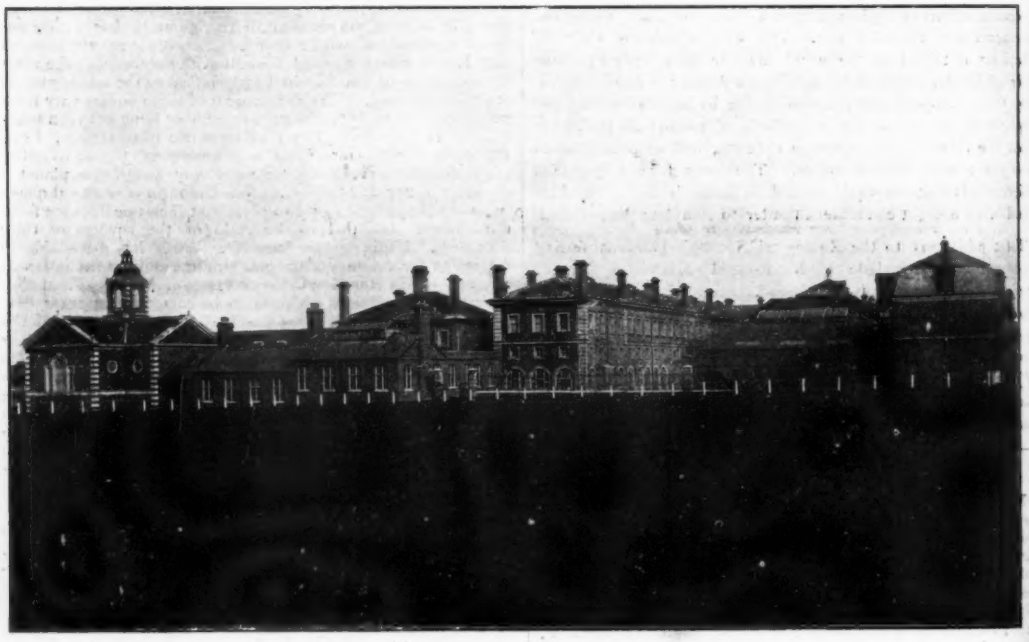


FIG. 1.—The Goldsmiths' Institute (from the back)

It is proposed in this article to give an account of three institutes in London which provide evening education and recreation for persons engaged in various trades and industries during the day. The institutes referred to are the Goldsmiths' Institute, the People's Palace, and the Battersea Polytechnic Institute. Other institutes, however, are referred to incidentally.

To begin with the technical and recreative Institute at New Cross, established and endowed by the Goldsmiths' Company. The expenditure of this Company upon their Institute has amounted to something like £80,000, and they have assigned it an endowment of £5000 per annum. Work was commenced in the Institute in October, 1891, Mr. J. S. Redmayne, of Merton College, Oxford, the Secretary, having been appointed about eighteen months previously in order to draw up a scheme of work and get together a strong and efficient staff. His duties are generally to supervise the staff and work, under the direction of the Governors, and generally act as resident representative of the Governors. It is hardly necessary to remark that the success of Polytechnic Institutes from an educational point of view depends very largely upon the Governors. The Goldsmiths' Institute is specially fortunate in having a very strong Governing Body, containing as it does the names of Sir Frederick Abel, Sir Frederick Bramwell, Sir Richard Webster, Sir Walter Prideaux, Dr. Anderson, and Mr. G. Matthey. It will be seen from Fig. 1, which shows a view of the Institute from the back, that the building covers a considerable area. The structure is the old Royal Naval School building adapted and extended to the requirements of the Institute. Some people considered it a disadvantage to take an institute like that of the Goldsmiths' Company into an old building, but, on the whole, there are many advantages in so doing. In a new building, the architect provides everything he is told to provide, but he does not leave room for future exigencies. In an old building, however, there are usually facilities for extensions in the direction which experience shows to be necessary.

The buildings of the Goldsmiths' Institute are considerably larger than those of any of the other London Polytechnics. A technical museum is now being added, which will be a special feature of this Institute.

The Institute differs from most other Polytechnics in the conditions of membership. The Battersea Polytechnic and the People's Palace exclude from membership of the institute, that is, from the social and recreative side, all except students. At the Regent Street Polytechnic, we believe, the rules are exactly the opposite way; those who care to pay for enjoying the social side can also, in virtue of so doing, get their education cheaper, that is to say, the class fees are reduced to members. We have no hesitation in saying that this plan is very bad. The first object of a Polytechnic should be the advancement of technical education. When this purpose is kept more or less in the background, the social and recreative side of the work tends to run rampant. In such cases the "House of Commons," where persons play at Parliament, is one of the most flourishing of the societies, and the "dreary drip of dilatory declamation" constitutes the pabulum of a large proportion of the members. The Governors of the Borough Institute have apparently found that too much attention to clubs and concerts is detrimental to educational work, for they have recently required that all new members should belong to one or more of the classes, and even now there seems to be room for improvement.

At the Goldsmiths' Institute there is one class fee for members

and students alike, but a student can get his membership—that is, his social and recreative privileges—at a cheaper rate through being a student. At the same time, people are not excluded from the social side of the Institute, even if they are not students. To put the matter briefly: at the Regent Street Polytechnic studentship is of less account than membership. At Battersea, the People's Palace, and, to some extent, Borough Road, there is no membership without studentship, while at the Goldsmiths' Institute studentship is the main thing, but those who are not students are not excluded from membership—they are only made to pay a little more for their privileges because they are drones.

It must not be supposed that the social or recreative side of Polytechnic Institutes consists entirely of play, for some extremely useful societies belong to it. The mechanical engineering and the chemical societies of the Goldsmiths' Institute are really doing splendid work. At their meetings students read papers of really scientific merit, and important problems in mechanics and chemistry are discussed. Too much praise cannot be given to societies of this kind, and we are glad to find that most institutes recognise their usefulness. They create interest and stimulate research; they help students to realise that scientific attainments must not be gauged by certificates, but by contributions to knowledge. Many institutes put forward as an advertisement of their efficiency the fact that a larger proportion of their students passed certain examinations than those of any other Polytechnic; that their students carried off such and such medals, and so on. This is all very well, but we look to Polytechnics for further evidence of efficiency than that shown by examinational honours. If the mere obtaining of certificates is inculcated into students as the end and aim of their work, the useful results expected from technical education will never arrive. The test, indeed, of the work done in Polytechnics must not be rated according to the list of examinational successes, but by the number and quality of papers published, and inventions made, by its alumni. So far as we know, no London Polytechnic Institute is yet able to produce this evidence of the development of originality, though it is impossible to say what may be done in the future. We would suggest, however, that such institutes should begin to record the additions to knowledge made by their students, and publish the lists year by year in their prospectuses. There would then be no difficulty in determining which of them all had borne the best fruits.

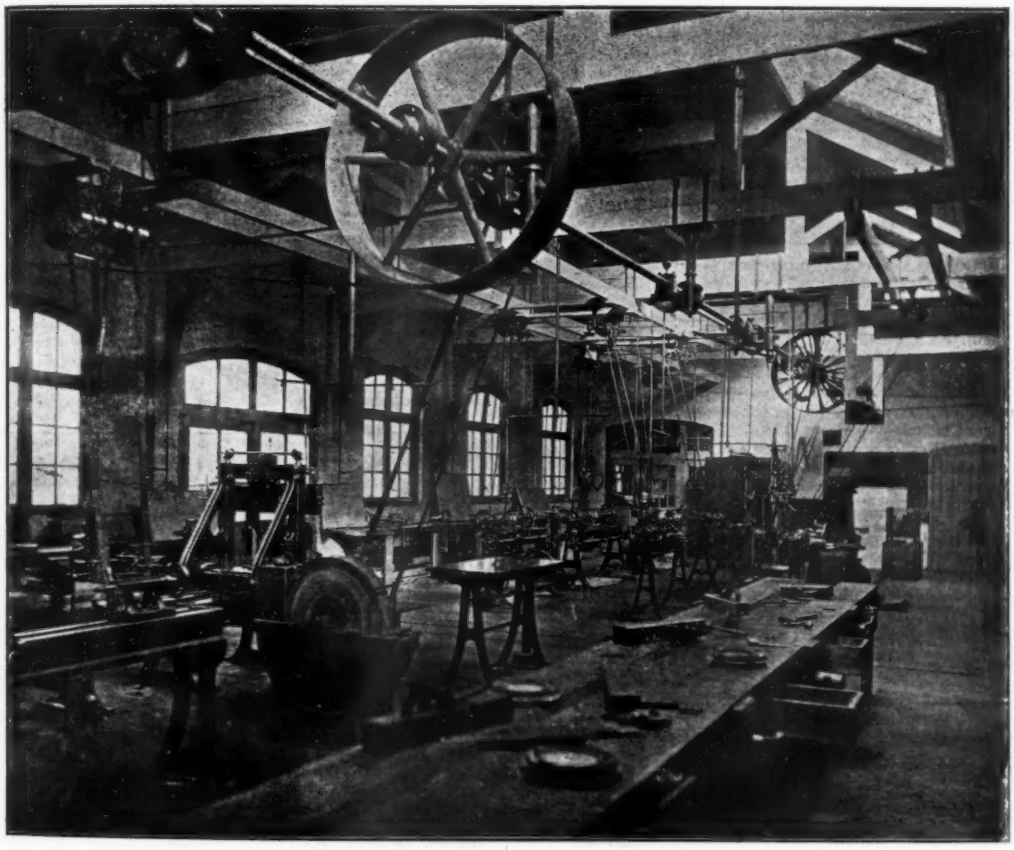


FIG. 2.—Engineering Workshop of the Goldsmiths' Institute.

The engineering department of the Goldsmiths' Institute is one of the best in London. Through the kindness of Mr. W. J. Lineham, the head of this section of work, we are able to give an illustration of the engineering workshop. It will be seen that the workshop is extremely well-fitted with useful machines—far better, indeed, than many of the shops in manufactories. Students who pass through workshop courses are made familiar with almost all the tools and appliances met with in ordinary practice. As for the courses themselves, we can suggest nothing to improve them. Each student is given a rough casting, and is expected to turn out from it a finished product. The first bit of work consists in grinding a cold chisel, both flat and cross cut, and in learning how to do simple marking off. For practice in chipping, filing, and scraping, a cast iron

block is worked into a paper-weight. A scribing block is then made, the castings and forgings being provided. This serves as exercise in chipping, filing, drilling, turning, and screwing. The student has afterwards to turn out a surface plate, hexagonal pattern, with handles. This work serves as exercise in planing, turning, drilling and screwing, filing and scraping. During the second year a ratchet brace is made, and a lathe; and third-year students make a shaping and a slotting machine. The course of study for engineering students is worth reprinting, for in it theory and practice are excellently combined:—

First year.	Second year.	Third year.	Fourth year.
Fitting and Machining (Shops).	Heat Engines, Advanced.	Smithing (Shops).	Smithing (Shops).
Engineering Lecture (Preliminary).	Mathematics (2nd stage).	Fitting and Erecting (Shops).	Pattern Making (Shops).
Applied Mechanics, Advanced.	Fitting and Machining (Shops).	Machine Construction (Special).	Smithing (Shops).
Machine Drawing, Elementary.	Machine Drawing, Advanced.	Engineering Lectures.	Engineering Lectures (Special).
Fitting and Machining (Shops).	Engineering Lecture.	Pattern Making (Shops).	Pattern Making (Shops)
The Steam Engine, Elementary.	Applied Mechanics, Advanced.	Finished Drawing and Design (Special).	Finished Drawing and Design (Special).
Mathematics (1st stage).	Fitting and Machining (Shops).		
Drawing Practice (Special).	Drawing Practice (Special).		

The course for building students is just as good. These courses are very popular, and they well deserve the success they have gained. Another successful class is one of carpentry for women; not merely Sloyd or woodwork, but real, practical carpentry. This is, we believe, the first class of the kind that has ever been held. The chemistry classes are specially good, and the laboratories the largest of all the Polytechnic Institutes.

Certain classes of the Goldsmiths' Institute are open to a limited number of *bonâ fide* artisans and handicraftsmen, on payment of half the ordinary fees. This is a rule well worth following in other institutes. Some of the trade classes are open to any one, irrespective of occupation. The clerk who has a taste for machine work may go through the same courses as fitters. If the clerk were allowed to waste his time in dabbling with the lathe and making pretty things, then he ought to be kept out; but when he is compelled to take up routine work, the case is different, for nothing but good can come of it. The young man who is willing to forego empty pleasures in order to obtain technical knowledge, is the one who will develop into an inventor. He works for the pure love of it, and something original may be confidently expected from him in time.

R. A. GREGORY.

(*To be continued*).

EXPLORATION OF THE HADRAMUT.

AT the last meeting of the Royal Geographical Society Mr. J. Theodore Bent gave an account of the archæological tour recently made by him and Mrs. Bent in Southern Arabia. On account of the fanaticism of the people, only one European had previously been able to penetrate to the broad valley of the Hadramut, which runs for one hundred miles or more parallel to the south coast of Arabia, gathering in tributary valleys from north and south, and carrying their drainage to the sea at Saihut. Opposition to the expedition was offered, as in the case of Mr. Hirsch, by the British officials at Aden, but in spite of this the Bents, accompanied by the accomplished Indian surveyor, Imam Sharif, and by botanical and natural history collectors, travelled in safety without disguise, and, though there were some hostile appearances, without injury through a large tract of unmapped country.

The region they traversed consisted of three parts, the narrow coast strip or Sahil, backed by the high plateau or Akaba, and the Hadramut and other valleys on the north, which lies between the southern plateau and the high desert land farther north. The whole coast strip from Mokulla to Saihut was extremely arid, only fertilised in patches by occasional hot springs. No traces of antiquities were found along the coast. The plateau of Akaba was ascended by the Wadi Howari, one of numerous short valleys which diversify the southern slope. The plateau presented the appearance of an unbroken plain with only a few flat-topped indications of a previously greater height to break its surface. This district was waterless except for tanks preserving precarious supplies of rain water along the paths. The highest point was found to be Haibel-gabrein, near the southern edge, its elevation being 5300 feet. The plateau was wandered over by a few Bedouins, and on its northern slope considerable numbers of frankincense trees occur, their produce being gathered not by the Bedouins but by Somalis, who come across in the season for that purpose. Where the plateau was trenched by the Hadramut valley the tributary valleys were found remarkably short and steep, cut out of the edge of plateau-like slices from a cake. All these valleys have their floors nearly on the same level as the main valley, and terminate at their heads in steep cliffs 700 or 800 feet high. Their appearance did not seem to justify the theory of water erosion, and Mr. Bent is inclined to consider them as lateral fjords excavated when the Hadramut was an arm of the sea. The rocks were exposed in steep cliffs of horizontally stratified red sandstone, The valley-bottoms are richly cultivated, thronged with villages shaded by palm groves, in effective contrast with the shadeless sterility of the plateau and the desert on either side. In this valley many archæological finds were made, principally in the shape of Himyaritic monuments and inscriptions dating back, in some instances, to B.C. 300. The people of the part of Arabia visited formed four distinct classes. The wild tribes of Bedouins, scattered irregularly, living in isolated houses or caves, rear camels and do all the carrying work. Next are the Arabs proper, who dwell in towns, cultivate the surrounding lands, and engage in extensive trade, sometimes visiting India and the Straits Settlements. Thirdly, the Sayyids and Sherifs form a sort of aristocratic hierarchy, tracing their descent from the Prophet; they are the religious fanatics who object to the admission of foreigners. The last class is that of the slaves, all of African origin, acting as labourers, personal servants, and soldiers to the Sultans of the many independent tribes into which the other classes of the population are divided.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—In connection with the visit of the Royal Agricultural Society to Cambridge next month, the University will bestow honorary degrees on a number of the high officers of the Society and others who have distinguished themselves in promoting agricultural science. The Duke of Devonshire, Chancellor of the University, is President of the Society, and will probably himself confer the degrees. The list of names submitted to the Senate includes H.R.H. the Duke of York, the Duke of Richmond and Gordon, Lord Cathcart, Sir John Thorold, Sir Dighton Probyn, Sir Nigel Kingscote, Sir John B. Lawes, Sir Joseph H. Gilbert, Mr. A. Peckover, the Lord Lieutenant of Cambridgeshire, and Mr. Albert Pell. The Master and Fellows of Trinity College have issued invitations to a banquet in the College Hall for June 26, at which the Prince of Wales, the Chancellor, and the recipients of honorary degrees, will be entertained.

WE learn from the *Scotsman* that two important draft ordinances were issued on May 14 by the Scottish Universities Commission. One of these deals with the matter of the regulations for the encouragement of special study in research and for the institution of Research Fellowships. The ordinance provides that the Senatus Academicus of each university may make regulations under which graduates of Scottish universities, or of other universities recognised for the purposes of the ordinance, or other persons who have given satisfactory proof of general education and of fitness to engage in some special study or scientific investigation, may be permitted such study or research in the university. The University Court in each university may establish Research Fellowships, which shall be open to research students only, and may set aside out of the General University Fund such sums as it may think fit to provide for stipends of Research Fellowships. The Court may also provide such sums as it may think fit in aid of the expenses of special research. Research students may be admitted to the degrees of Doctor of Science or of Doctor of Letters of the university in

which they have studied as research students, under conditions prescribed in another ordinance of the Commission just issued dealing with the regulations for higher degrees in arts and science. In regard to the degree of Doctor of Science, it is provided that graduates who have taken the degree of Master of Arts with honours in mathematics and natural philosophy, may proceed to the degree of Doctor of Science in the same university after the expiry of five years from the date of their graduation in arts, under the same conditions as if they held the degree of Bachelor of Science. Research students within the meaning of the ordinance relating to the regulations for the encouragement of special study and research may offer themselves for the degree of Doctor of Science of the university in which they have pursued some special study under that ordinance, although they have not taken the degree of Bachelor of Science, or the degree of Master of Arts with honours in mathematics and natural philosophy in that University, under the following conditions :—

(1) That they hold the degree of Bachelor of Science or Bachelor of Medicine of a Scottish or any recognised university, or a degree of any such university, which the Senatus Academicus shall hold to be equivalent to the degree of Bachelor of Science or to the degree of Master of Arts with honours in mathematics and natural philosophy.

(2) That they have spent not less than two winter sessions or an equivalent period as research students in the university granting the degree, and that they produce evidence of satisfactory progress in the special study or research undertaken by them during that period.

(3) That a period of not less than five years shall have elapsed from the date of the graduation required in sub-section (1) of this section.

All candidates for the degree of Doctor of Science have to present a thesis or a published memoir or work, to be approved by the Senatus on the recommendation of the Faculty of Science; provided that, if required by the Senatus, the candidate shall also be bound to pass such an examination as may from time to time be determined. The thesis must be a record of original research undertaken by the candidate, and has to be accompanied by a declaration signed by him that the work has been done and the thesis composed by himself.

It will be noted with regret that no provision is made for the publication of the thesis. This is a serious omission, for scientific work, if worthy of a degree, is surely worthy of publication.

THE name of Dr. D. H. Scott should have been added last week to the list of Oxford men who are among the selected candidates for the Fellowship of the Royal Society.

SCIENTIFIC SERIALS.

American Journal of Science, May.—Observations on the derivation and homologies of some Articulates, by James D. Dana. It is probable that all Articulates are successional to the Rotifers. There is reason for believing further that the types of Annelids, Crustaceans, and probably that of Limuloids, had their independent Rotifer origin. The line to the lower and earlier Arachnods, that is to the Scorpions, leads up from the early Pterygotus—like Limuloids. A line of succession from Worms to Myriapods and from these to Insects, although not proved geologically, is suggested by the fact that in low-grade insects there is no proper metamorphosis, while in the higher the larval stage is lower and lower in embryonic level. The larval stage would result from an attendant retrograde embryonic change to a line parallel with the Myriapod, and beyond to the memberless condition of a worm.—Notes on apparatus for the geological laboratory, by J. E. Wolff. This paper contains instructions for making diamond saws, for sawing thin sections of rock specimens, and for the management of the arc light for purposes of projection.—An elementary expression in thermoelectrics, by Carl Barus. Two metals are thermo-electrically identical when the sign and the number of available molecular paths which the current (or better, the elementary charge) is free to take, is the same in both metals.—Gases in Kilauea, by William Libbey. Observations of bluish-green flames bursting out from the lava, made with a pocket spectroscope, revealed what was probably carbonic oxide and some hydrocarbons, shown by a band in the green, and bands in the red and blue.—Transformations of mechanical into chemical energy, III. Action of shearing stress continued, by M. Carey Lea. The most instructive experiment was that with mercuric oxide. Half a gram was taken, and after trituration the unchanged oxide was dissolved out by repeated digestions with hydrochloric acid. The reduction products were dissolved out by a few drops of aqua regia, filtered, and precipitated by hydrogen sulphide. The amount of sulphide obtained correspond to the reduction of ·0329 gram of mercuric oxide. The amount of mechanical energy transformed into chemical was found to be 322 gram meters. Silver oxide, potassium ferricyanide, ferric ammonia, alum, silver carbonate and sulphite, and sodium chloroaurate were also successfully reduced by grinding, but not cupric chloride. A porcelain mortar was found much more efficient than one made of agate.

Bulletin of the New York Mathematical Society, vol. iii. No. 7, April 1894. (New York: Macmillan.) Prof. H. Maschke, in a thorough analysis of Harkness and Morley's "Theory of Functions"—it occupies pp. 155-167 of the present number—records the opinion that "the great merits of this valuable work will secure it a high rank in modern mathematical literature" Dr. G. A. Miller, in a note on substitution groups of eight letters (pp. 168-9), makes an important addition to Dr. Cole's list in vol. ii. which is suitably acknowledged by him. Prof. J. McMahon writes on the general term in the reversion of series (pp. 170-2). In the notes the Simson-Lines are printed Simpson's lines. Dr. J. S. Mackay's discovery that no such property has been found in R. Simson's published writings, has not yet "caught on." There is a long list of new publications.

L'Anthropologie, tome v. No. 2, March-April, 1894.—M. Ed. Piette contributes some notes to be used for the history of primitive art. The bulk of the accumulations found in caves are composed of broken bones of animals eaten by man, and a cursory examination of the débris suffices to show that whilst the remains of Equidæ predominate in the lower strata, those of Cervidæ are more abundant in the upper strata. Hence, the Glyptic period, as M. Piette calls the age in which quaternary man was in the habit of ornamenting bone, horn, ivory, and stone with sculpture or engraving, has two primary divisions—the Equidian age and the Cervidian age. The former of these may be considered to have two subdivisions, namely the elephantine, or ivory epoch, and the epoch of the horse, called by M. Piette the Hippiquian epoch; two subdivisions are also comprised in the Cervidian age, viz. the epoch of the reindeer and that of the red-deer, or the Rangiferian epoch and the Elaphian epoch.—In a paper on the female deity and the sculptures of the Allée Couverte of Épone, M. Emile Cartailhac describes several blocks and menhirs from various parts of the country on which a female figure is sculptured with more or less detail. On the breast of one of these figures is the representation of an implement or weapon much like the ancient Egyptian boomerang. In a dolmen, excavated by Canon Greenwell at Folkestone, there were found two small cylindrical blocks of limestone, covered with geometrical designs, in the middle of which, in a prominent place, is seen a human face, confined to the forehead, nose and eyes, but, so far, identical with the French sculptures.—M. Maurice Delafosse gives an account of the Hamites of Eastern Africa, in a brief summary of the ethnographical parts of the most recent works that have appeared on the subject. He refers more particularly to the valuable monograph by Dr. Philipp Paulitschke, entitled "Ethnographie Nordost-Afrikas, die materielle Cultur der Danâkil, Galla und Somâl" (Berlin, 1893). The Danakil, Somal and Galla peoples, each comprising a large number of tribes, divide the eastern horn of Africa between them. The Danakil dwell along the coast of the Red Sea and to the east of Abyssinia, the Somal occupy the whole of that point of Africa which projects into the Indian Ocean, while the Galla tribes inhabit the country west of the Somal and to the south of the Danakil and Abyssinia. They are all of Hamitic origin, and differ as much from their neighbours, the Berbers and the Semites of the north, as they do from the negroes and the Bantu of the south. Their hair is not frizzly, but only woolly, and sometimes it attains to a considerable length, especially among the women. The nose is not flat; it is frequently broad and short, but it is sometimes even aquiline. The lips are rarely protuberant, though they are almost always thick. M. Salomon Reinach continues his account of sculpture in Europe prior to Greco-Roman influence; and M. E. Vouga discusses the probable age

of the lacustrine stations in Switzerland. M. Vouga calculates that the layer of mud that overlies the bronze bed to the thickness of about 0·12 m. has required 3000 years for its accumulation, that the deposition of the bronze bed itself occupied one or more centuries, a layer of lacustrine mud between the bronze bed and the stone bed (0·12m. thick) took another 3000 years to accumulate, and that the stone bed probably took twice as long in its formation as the bronze bed did. The stations have been suddenly abandoned, with all the personal property of the inhabitants, several times, and completely deserted: once by the men of the pure stone age—the stone of the country; a second time perhaps, but very probably, by other men who possessed nephrite and jade implements, axes and polished hammers, and articles of copper; lastly, by the men of the bronze age. No satisfactory explanation of these facts has yet been offered, but perhaps the frequent change of level of the lake waters may be to some extent responsible for them.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 26.—"On the Specific Heats of Gases at Constant Volume. Part II. Carbon Dioxide." By Dr. J. Joly, F.R.S.

In the former experiments on this gas, recorded in the first part of this research,[1] the highest absolute density at which the specific heat was determined was 0·0378. In the present observations the determinations of specific heat have been carried to densities at which the substance was partly in the liquid state at the lower limit of temperature of the experiments. Observations dealing with true specific heat, uncomplicated by the presence of thermal effects due to the presence of liquid, are limited by the density 0·1444. At this density the mean specific heat over the range, 12° C. to 100° C., is 0·2035.

These observations, combined with those contained in Part I. (*loc. cit.*), afford a well defined line, which rises slowly at the higher densities, turning away from the axis of density.

According to an empirical equation to this line, the specific heat of carbon dioxide at constant volume is given in terms of its variation with density ρ, as follows:

$$Cv = 0{\cdot}1650 + 0{\cdot}2125\rho + 0{\cdot}3400\rho^2$$

"On the Specific Heats of Gases at Constant Volume. Part III. The Specific Heat of Carbon Dioxide as a Function of Temperature." By Dr. J. Joly, F.R.S.

In order to investigate the question of the variation of the specific heat of carbon dioxide with temperature, a steam calorimeter was constructed having double walls of thin brass, between which the vapour of a liquid boiling under atmospheric pressure could be circulated. The vessels used in the experiments were hung in the closed inner chamber. Into this chamber steam could be admitted after the temperature had become stationary and the same as that of the jacketting vapour. In this way the initial temperature could be varied.

Experiments at various densities and over four intervals of temperature were carried out. The densities chosen were 0·0456: 0·0800; 0·1240; 0·1800, and 0·1973. The intervals of temperature over which the gas at each density was investigated were: air temperature to 100°; 35° C. (boiling point of ether) to 100°; 56° (boiling point of acetone) to 100°, and 78° (boiling point of ethyl alcohol) to 100°.

The results are plotted on 5 equi-density lines, in which the precipitation due to the calorific capacity of the gas between t_1, and 100° is plotted against the initial temperature t_1 in each case. If the specific heat is invariable these are right lines. This proves to be sensibly the case for the lines $\rho = 0{\cdot}0456$ and $\rho = 0{\cdot}0800$; those of lowest density.

The next line, 0·124, is nearly rectilinear over the higher ranges, but pursued in the direction of decreasing temperature it rises markedly, thus indicating that the specific heat at constant volume falls in value with increasing temperature. The line $\rho = 0{\cdot}1800$ and the one close above it, $\rho = 0{\cdot}1973$, show this variation very markedly. Their variation below the critical temperature is complicated by the presence of liquid.

[1] "On the Specific Heats of Gases at Constant Volume," Part I. *Phil. Trans.* vol. clxxxii. 1891. pp. 73-117.

The following empirical equation expresses the line $\rho = 0{\cdot}124$ calculated into a line of variation of specific heat with temperature:—

$$Cv = a(100-t) + b(100-t)^2 + c(100-t)^3,$$

where t is the initial temperature of the experiment in centigrade degrees;

$$a = 0{\cdot}19020000,$$
$$b = -0{\cdot}00006750,$$
$$c = 0{\cdot}00000182.$$

Geological Society, May 9.—Dr. Henry Woodward, F.R.S., President, in the chair. The following communications were read:—Carrock Fell: a Study in the Variation of Igneous Rock-masses. Part I. The Gabbro. By Mr. Alfred Harker. The author opened with an account of the general relations of the intrusive rock-masses of the district, and proceeded to deal more particularly with the gabbro, which forms the earliest intrusion. A petrological description of the Carrock Fell gabbro followed a study of the variations observed in different parts of the mass. The rock becomes progressively more basic from the centre to the margin, passing from a quartz-gabbro with as much as 59½ per cent. of silica to an ultrabasic type with as little as 32½. The latter in extreme cases contains nearly 25 per cent. of iron-ores, partly titaniferous. This was compared with the igneous iron-ores described by Vogt in Scandinavia, &c., and the probable physical cause of the remarkable variation in the gabbro was discussed. Other modifications of the gabbro were briefly noticed, due on the one hand to metamorphism of the rock by a somewhat later intrusion of granophyre, on the other hand to the gabbro-magma having enclosed considerable masses of the basic lavas of the district, which are themselves highly metamorphosed. The paper was commented upon by Mr. Marr, Prof. Judd, Prof. Cole, and Mr. Rutley.—The Geology of Monte Chaberton, by Mr. A. M. Davies and Dr. J. W. Gregory. The importance of the Chaberton district, as affording a key to the general geology of the Cottians, was explained, and the opinions of previous observers referred to. The mountain was examined from three sides—that of the Grand Vallon; the approach from Mont Genèvre by the Col de Chaberton; and that of the Clos des Morts Valley. The following are the conclusions arrived at:—(1) The well-known Chaberton serpentine is intrusive into the calc-schists, and yields fragments to the *cargneules* of the Trias: it is therefore a *pre-Triassic* intrusion. (2) There are on the mountain other fairly basic schistose rocks (quartz-chlorite-schists) which cut the Trias, and are therefore *post-Triassic*. (3) The contorted beds in the Clos des Morts Valley are fossiliferous limestones, and it is from them that the fallen blocks previously recorded were derived. The only recognisable fossil is *Calamophyllia fenestrata*, Reuss, a characteristic coral of the Gosau Beds. In spite, therefore, of the doubts of Kilian and Diener, the opinion expressed by Neumayr as to the existence of Cretaceous rocks in this part of the Alps is confirmed. (4) The earth-movements of the mountain are described: they include ordinary folds, inversions, faults, and an important thrust-plane. (5) It is suggested that in addition to the two series of intrusive rocks above mentioned as pre- and post-Triassic, a third series of late Cretaceous or Tertiary date may be represented in the Mont Genèvre and Rocciavré masses.—Cone in Cone. How it occurs in the Devonian (?) Series in Pennsylvania, U.S.A., with further details of its structure, varieties, &c., by Mr. W. S. Gresley. The author described cone-in-cone structure occurring in the Portage Shales of Pennsylvania, and gave details concerning the nature of the structure as seen in these shales. He criticised the explanation of Mr. J. Young as to the origin of the structure, and concurred in a great measure with the views of those who have suggested that the formation was due to pressure acting on concretions.

Mathematical Society, May 10.—Prof. Greenhill, F.R.S., Vice-President, in the chair.—The following communications were made: On the kinematical discrimination of Euclidean and non-Euclidean geometries, by Mr. A. E. H. Love. The problem of Helmholtz, to lay down axioms concerning motion, by which the Euclidean, elliptic, and hyperbolic geometries shall be distinguished from all other imaginable geometries, has been recently solved by Sophus Lie in the third part of his "Theorie der Transformations-gruppen" (1893), and he adds the remark that the group of the Euclidean motions is distinguished from the two groups of non-Euclidean motions by the

possession of a real invariant sub-group. This remark obviously refers to translations, and in fact it appears to have been previously noticed that in the elliptic and hyperbolic geometries, the transformations that correspond to translations do not form a group. In the present communication a number of representations of elliptic and hyperbolic geometry are described and illustrated with the object of making this kinematical distinction between the Euclidean and the other geometries intuitively obvious.—Permutations on a regular polygon, by Major P. A. MacMahon, F.R.S.—The stability of a tube, by Prof. Greenhill (Dr. J. Larmor, F.R.S., *pro tem.* in the chair). The difficulties of constructing a theory for the stability of a tube, subject to external pressure and end thrust, have been discussed by Mr. A. B. Basset in the *Phil. Mag.* September 1892. Similar investigations have been undertaken by Mr. Love and Mr. Bryan in the *Proceedings* of the London Math. Society. The analytical difficulties due to the difference of pressure on the two sides of the plate, have not yet been overcome, so that the investigation of the present paper must be taken as provisional, as it proceeds on the old theory, as laid down in Thomson and Tait's "Natural Philosophy." The chief object is to determine the number of segments or waves into which the cross section of the tube will tend to break, as the supporting influence of the ends is made to operate at sections which are brought closer and closer together; the influence of the end thrust is also taken into account. A differential equation is obtained for w, the infinitesimal normal displacement of the tube, of the form

$$A\left(\frac{d^4w}{dx^4} + 2\frac{d^2w}{dx^2dy^2} + \frac{d^4w}{dy^4} + 2\frac{d^2w}{a^2dx^2} + \frac{w}{a^4}\right) + A\sigma\frac{d^2w}{dx^2} + X\frac{d^2w}{dx^2} + Z\alpha\left(\frac{d^2w}{dy^2} + \frac{w}{a^2}\right) = 0 \quad . \quad (A)$$

where x is measured parallel to the axis of the tube, and y circumferentially; a denotes the radius of the tube, b its thickness, A the flexural rigidity, σ Poisson's ratio, X the longitudinal thrust in the tube per unit length of cross section, and Z the external applied pressure; the inch and pound are taken as units of length, so that the theoretical results may be compared immediately with experimental values; to do this it is assumed provisionally that we may put $A = \frac{1}{12}M b^3/(1-\sigma^2)$, where M denotes Young's modules of elasticity. If the tube breaks circumferentially into n waves, we put

$$\frac{d^2w}{dy^2} = -\frac{n^2w}{a^2}, \quad \frac{d^4w}{dy^4} = \frac{n^4w}{a^4};$$

and equation (A) becomes

$$\frac{d^4w}{dx^4} - 2n^2\frac{d^2w}{a^2dx^2} + (n^2-1)^2\frac{w}{a^4} + \left(\sigma + \frac{Xa^2}{A}\right)\frac{d^2w}{a^2dx^2} - (n^2-1)\frac{Za^3}{A}\frac{w}{a^4} = 0 \quad . \quad (B)$$

For cylindrical collapse, when the supporting influence of the ends is left out of account, $\frac{d^2w}{dx^2}$ is zero, and therefore

$$\frac{Za^3}{A} = n^2 - 1, \; nZ = \frac{n^2-1}{12}\frac{M}{1-\sigma^2}\left(\frac{b}{a}\right)^3.$$

But if the ends of the tube are supported or strengthened, the collapsing pressure is obviously increased, so that

$$\frac{Za^3}{A} - (n^2-1)$$

is positive. If the supporting influence is due to a series of equidistant strengthening rings, as is a caisson, l inches apart, preserving accurately the circular form at the corresponding section, while permitting slight changes of direction in the longitudinal seams, we put

$$\frac{d^2w}{dx^2} = -\frac{\pi^2w}{l^2}, \quad \frac{d^4w}{dx^4} = \frac{\pi^4w}{L^4};$$

so that (B) becomes

$$\left(\frac{\pi a}{L}\right)^4 + \left(2n^2 - \sigma - \frac{Xa^2}{A}\right)\left(\frac{\pi a}{L}\right)^2 + (n^2-1)^2 - (n^2-1)\frac{Za^3}{A} = 0 \quad . \quad . \quad . \quad (C)$$

In practice X is proportional to Z, when it is not zero; and to determine the number n of segments into which the tube collapses, we may put $Za^3/A = y$, and $(\pi a/l)^2 = x$, and draw the hyperbolas represented by (C) for values of $n = 1, 2, 3, \ldots$; and the points of crossing of these hyperbolas will represent the separating states when an integral change in n is about to take place. The case of $n = 1$ would only occur when the tube was used as a long cylindrical column, on the point of buckling sideways, without crippling; we now find that the formula assigns a critical thrust which is only $\frac{2}{3}(b/a)^2$ of that given by the usual theory, due to Euler.—Researches in the calculus of variations, Part v., the discrimination of maxima and minima values of integrals with arbitrary values of the limiting variations; Part vi., the theory of discontinuous or compounded solutions, by Mr. E. P. Culverwell.

Physical Society, May 11.—Walter Baily, Vice-President, in the chair.—A mathematical communication on electromagnetic induction in plane, cylindrical, and spherical current sheets and its representation by moving trails of images, by G. H. Bryan (part 1, general equations), was read by Dr. C. V. Burton, who also explained some of the parts in greater detail. After mentioning that the magnetic field due to induced currents in thin conducting sheets placed near moving magnetic poles could be represented by moving trails of images of those poles, the author goes on to say that in the paper, the surface-conditions which hold at the surfaces of the sheets are deduced directly from the fundamental laws of electromagnetic induction. (1) The total current across any enclosed portion of a surface which always contains the same particles is equal to $1/4\pi$ of the line-integral of the magnetic force round the curve bounding the surface; and (2) the rate of decrease of the surface integral of magnetic induction across any enclosed surface which always contains the same particles to equal to the line-integral of electromotive force round the curve bounding the surface. By working with the scalar magnetic potential instead of vector-potential, the investigation is simplified. In addition to the above laws, the author makes the usual assumptions that displacement currents in the dielectric are so small as to be negligible, and that the induced currents are distributed uniformly through the thickness of the sheet. On these suppositions the surface conditions satisfied by the potentials at the two sides of plane, cylindrical, or spherical sheets are determined, and with an additional limitation as to the thickness of the sheet fulfilling certain conditions, extended to current sheets of other forms. In the latter part of the paper a synthetic determination of the images in a plane sheet is given and expressed in the form of a definite integral. In reading the paper to the meeting Dr. Burton pointed out several misprints in the proof.—Prof. Minchin showed that equation (1) of the paper $(\Omega_2 - \Omega_1 = 4\pi\phi + \text{constant}$, where Ω_2 and Ω_1 are the magnetic potentials at the two sides of the sheet, and ϕ the current function), could be deduced by purely mathematical reasoning instead of being based on the laws of electromagnetic induction. Moreover, it was true for any function whatever and did not depend on ϕ being the current function. Equation (2) $\left(\frac{d\Omega_2}{dz} = \frac{d\Omega_1}{dz}\right)$ followed immediately from the fact that the magnetic force was continuous. The latter part of the paper might be simplified by integrating the linear partial differential equation (15)

$$\left(\frac{d^2\Omega'}{dz\,dt} - R\frac{d^2\Omega'}{dz^2} = -\frac{d^2\Omega_0}{dz\,dt}\right)$$

in the ordinary way, for the form was one for which the auxiliary equations are well known. Dr. Burton, in reply, said he thought Mr. Bryan's reason for developing the equations from the laws of electromagnetic induction was to give his work a physical rather than a mathematical basis.—A paper on dielectrics was read by Mr. Rollo Appleyard. In testing the insulation resistance of celluloid, by having a sheet pressed between two metal plates, the author noticed that the resistance, which was very high, *decreased* as the time the testing battery was left on increased. The "electrification" (using the word to indicate the rate of diminution of galvanometer deflection) was therefore *negative*. The resistance also diminished greatly with increase of battery power, and a considerable amount of hysteresis was observed, the resistance at any given voltage, after a minute's electrification, depending on the previous history of the specimen. On making contact with the surfaces of the celluloid by mercury instead of by solid metal, the abnormal results disappeared, little or no resistance-hysteresis or "electrification" being present, and

only a small diminution of resistance with increase of voltage. For a sheet 6 mils thick the resistance between opposite faces 5½ inches diameter was of the order 30 megohms, and one specimen broke down at 1200 volts. The celluloid condensers used in the experiments were found to discharge slowly at first, and after a certain time the deflection of the galvanometer became reversed, and attained a steady negative value. This the author attributes to an E.M.F. of about 0·0006 volt between the mercury and celluloid. Similar experiments on gutta-percha tissue showed no such E.M.F., and the "electrification" was normal. The resistance usually attained a maximum for voltages between 600 and 800. Although the tissue had a thickness of only 2 mils (0·002"), it stood a pressure of 1200 volts, and offered a resistance between circular faces 5½ inches in diameter of about 3000 megohms. The opaque white spots seen in celluloid under the microscope, led the author to test the behaviour of mixtures of conducting and insulating materials. A strip of gutta-percha was warmed, and coarse brass filings scattered over it as thickly as possible. In spite of this the resistance was practically infinite even when tested with 750 volts. A number of rods were made from mixtures of brass and gutta-percha in various proportions, and on testing these it was found that if the weight of filings exceeded about twice that of the gutta-percha, the resistance of a rod 20 inches long, ¾ inch diameter, was small (sometimes a fraction of an ohm), whereas a slightly smaller proportion yielded rods having resistances measured in thousands of megohms. Such rods were found to be affected by oscillating discharges in a manner similar to Prof. Minchin's "impulsion" cells and M. Branly's tubes of filings. Experiments were also made on the behaviour of such rods when subjected to high alternating pressures. This caused small local arcs to form along the rods, but did not permanently destroy their high resistance.—In connection with Mr. Appleyard's paper, a note on the behaviour of certain bodies in presence of electromagnetic oscillations, by Prof. G. M. Minchin, was read by Mr. Elder. Referring to the employment of impulsion cells, metallic films, &c., for detecting the modes of electromagnetic vibrations, he says that so far the physical state of such bodies are too variable to be of service. Metallic surfaces formed by embedding fine metallic powders in films of gelatine, shellac, or sealing-wax, are, as described in a previous communication to the Society, found to act as insulators, but become conducting when subjected to strong electromagnetic disturbances. After a current has once passed through such a film its resistance is changed by very feeble impulses, whereas previously it failed to respond to strong ones. On breaking contact by removing the electrode from the surface, the film loses its conductivity, the time necessary to do this depending on the hardness of the matrix. The resistance of a film containing tin powder, measured between the rounded tips of two platinum wires, 1 c.m. apart, varied under the electromagnetic impulses from infinity to 130 ohms. In conclusion, the author points out that with films and tubes the whole phenomenon relates to change of resistance, whereas impulsion cells may have currents from external sources passing through them whilst in either the sensitive or insensitive states.—Mr. Bright and Mr. Enright asked questions as to the electrification of gutta-percha, and the bridge connections in the resistance tests of the semi-conducting rods respectively, to which Mr. Appleyard replied.

Royal Meteorological Society, May 16.—Mr. R. Inwards, President, in the chair.—Mr. W. Ellis, F.R.S., read a paper on the relative frequency of different velocities of wind, in which he discussed the anemometer records of the Greenwich Observatory for the five years 1888–1892, with the view of ascertaining the number of hours during which the wind blew, with each of the different hourly velocities experienced during the period. The results of this discussion show that the wind blew for the greatest number of hours with the hourly velocities of ten and eleven miles.—Mr. W. Marriott gave an account of a series of observations on the audibility of "Big Ben" at West Norwood, which he had carried on for a period of five years. The clock tower at Westminster is five and a half miles distant from the point of observation in a north-by-west direction. The large bell "Big Ben" was designed by Lord Grimthorpe, and was cast in 1858; its weight is about fourteen tons. It is 9 ft. 5½ ins. in diameter, and 9⅜ ins. in thickness, its tone being E. The observations were 976 in number, and were made at the hours of 9 a.m. and 9 p.m. The bell could be heard more frequently in the evening than in the morning, and on Sundays it was more frequently audible than on week-days. The direction of the wind most favourable for hearing "Big Ben" was between west and north. The observations were also discussed in relation to temperature, moisture, cloud, and barometric pressure.—A paper by Mr. A. W. Moore was also read on earth temperatures at Cronkbourne, Isle of Man, 1880–1889.

Royal Microscopical Society, April 18.—Mr. A. D. Michael, president, in the chair.—Dr. W. H. Dallinger directed attention to a stereoscopic photomicrograph of Heliopelta, which had been presented to the Society by Dr. W. C. Borden, of New York.—Dr. Dallinger read a short paper from Dr. H. G. Piffard, in reference to a method which he had adopted for the examination of some of the old immersion objectives.—Mr. J. W. Brown exhibited a "home-made" microscope.—Prof. F. J. Bell read a letter from M. C. J. Pound, describing the laboratories of the Stock Institute of Queensland, which had recently been instituted for the purpose of investigating the nature and causes of animal diseases in that colony.—Mr. J. G. Grenfell read a paper on the tracks, threads, and films of oscillatoriæ and diatoms, illustrating his subject by diagrams and specimens. Mr. T. Comber and the President made some remarks on Mr. Grenfell's paper.

PARIS.

Academy of Sciences, May 15.—M. Lœwy in the chair.—On the influence of bending in telescopes mounted as coudé equatorials, by MM. Lœwy and Puiseux.—Researches on the augmentation of crops by introduction into the soil of large quantities of carbon bisulphide, by M. Aimé Girard. The author shows that, for at least two years after treating soils with carbon bisulphide, wheat, oats, beetroot, potatoes, and clover yield much heavier crops than on soil not treated. He traces the increased production rather to the destruction of insect pests than to any action on parasites belonging to the vegetable kingdom.—Observation of Tempel's comet (1873 II.) made at Algiers Observatory. A telegraphic despatch transmitted by M. Tisserand.—On the periodic comet Tempel (1873 II.), by M. L. Schulhof.—Observations of comet Denning (1894, March 26) made at Toulouse Observatory, by M. E. Cosserat.—Observations of Gale's comet (1894, April 3) made at Lyons Observatory, by M. J. Guillaume.—Observations of the same comet made with the coudé equatorial at Lyons Observatory, by M. G. Le Cadet.—Graphic ephemerides giving the co-ordinates of the stars for the purposes of navigation, by M. Louis Favé.—On the equations of mechanics, by M. Wladimir de Tannenberg.—Determination of the relative intensity of gravity, made at Joal (Senegal) by the expedition sent out by the Bureau des Longitudes to observe the total eclipse of the sun on April 16, 1893, by M. G. Bigourdan. Taking $g = 981$ at Paris, at Joal the mean value of g, reduced to sea-level, is 978·437. This result confirms Defforge's law that g has a characteristic value for the littoral of the same sea, of which the variation follows exactly Clairaut's law of the sine squared of the latitude.—On the physical properties of pure nitrous oxide, by M. P. Villard. The author describes the preparation of the pure gas by a liquefaction method, and compares the densities of the liquid and its vapour from 0° to 36°·3. He finds the critical temperature of the pure gas to be 38°·8 as compared with Dewar's value, 35°·4, and Janssen's 36°·4. The critical volume, density, and pressure are respectively 0·00436, 0·454, and 77·5 atmospheres.—On the stability of dilute solutions of corrosive sublimate, by M. Léo Vignon. The stability depends on the absence of alkaline matter which may be present in the water used or derived from the air or the glass of the containing vessel.—On the chemical character and constitution of ethylic acetoacetate, by M. de Forcrand. From a consideration of thermal data, the author concludes that ethylic acetoacetate most nearly resembles phenols, that it is neither an acid nor a ketone, but a tertiary alcohol of a special type, and should be represented by the formula

$$CH_3.C(OH):CH.COOEt.$$

—Comparative study of the isomeric nitrobenzoic acids, by M. Oechsner de Coninck.—The Diptera parasitic on Acridians: viviparous Muscidæ, *à larves sarcophages*. Aptenia and parasitic castration, by M. J. Künckel d'Herculais.—On the fixity of race in the cultivated mushroom, by MM. Costantin and L. Matruchot. The peculiarities distinguishing the varieties recognised by mushroom growers are hereditary.—Remark concerning a recent communication, by M. Issel, on the Zante earth-

quakes, by M. Stanislas Meunier.—M. d'Abbadie describes a new method of measuring a geodetic base-line in presenting volume li. of "Memoires de la Section topographique de l'État-Major-Général russe," on behalf of M. Vénukoff.

BERLIN.

Meteorological Society, April 3. — Prof. Hellmann, President, in the chair.—Dr. Rassner spoke concerning the measurements of the height of clouds at the Eiffel Tower, which had given 150 m. as the lowest value, and discussed the different methods of determining the height of clouds by means of artificial illuminants as proposed and used by La Cour, Cleveland Abbe, Jesse, Hasen, and others. The speaker himself on two occasions had the opportunity of measuring the height of clouds; the first, in the summer of last year, was a thunder cloud, whose height he determined, with the aid of an electric lamp, to be about 80 m.; on the second occasion, in January of this year, he was able by the use of an intermittent benzole light, to measure the height of the clouds to 750 m.—Dr. Schubert made a communication concerning the cyclone of February 12 last, which did very great damage in the forest of Freienwalde and Chorin, especially in the pine districts, where the trees were torn up by the roots, and blown down by the storm. A series of beautiful photographs illustrated the devastation produced by the storm.

Physiological Society, April 13.—Prof. du Bois Reymond, President, in the chair.—Dr. Krüger spoke concerning the determination of the uric acid and nuclein bases in urine by precipitation with copper sulphate and sodium bisulphide. With the help of these reagents one can determine exactly the nitrogen of the uric acid and of the nuclein bases. If the nitrogen of the uric acid be now determined by means of the Ludwig-Salkowsky method, one arrives at a quantitative determination of the nuclein bases. On the other hand, the uric acid in the urine may be changed into allantoin by manganese, in which case treatment with the copper sulphate-sodium bisulphide yields only the nitrogen of the nuclein bases. This is then deducted from the total nitrogen which had been found before, and so one obtains quantitative estimation of the uric acid. These reactions were verified in a great number of experiments.—Dr. Jacob reported on a case of leukæmia which he had investigated in conjunction with Dr. Krüger. They first showed that an increase in the nitrogen of the uric acid and nuclein bases of the urine is associated with the increase in the number of the leucocytes. After injection of an extract of spleen, there was observed first a decrease, and later an increase in the number of leucocytes. In proportion to the increase of the leucocytes there was an increase in the quantity of urine excreted and in the amount of uric acid and nuclein bases. When after some days the number of leucocytes decreased the quantity of urine, of uric acid, and of nuclein bases also diminished.—Dr. Lilienfeld communicated the results of experiments which he had made on the condensation of glycocol ether, and on the union of a diamine base derived from glycocol with leucine ether and tyrosine ether. The condensation of glycocol ether and tyrosine ether resulted in a body which gave the reactions of glutin, and resembled glue in appearance, while the union of the above-mentioned three substances gave a proteid-like body, which showed the biuret reaction, and was dissolved by pepsin. The conjectures as to the constitution of these three substances will be tested by further experiments.

April 27.—Prof. du Bois Reymond, President, in the chair. Dr. Ad. Loewy communicated the results of his experiments on the influence of rarefied and compressed air on the circulation. As he showed in earlier experiments a diminution of pressure to about 450 mm. of mercury was tolerated very well and did not lead to any real disturbance, and that the lowered oxygen tension, produced either by still greater rarefaction or by the addition of carbonic acid to the air breathed, is compensated for by deeper respirations. The speaker desired now to determine by experiment whether, with rarefaction of the air, compensating changes can be observed in the vascular system. In particular he determined the velocity of the blood flow by the method recently devised by Prof. Zuntz (NATURE, vol. xlix. p. 168) in animals which respired in rarefied air of about ½ atmosphere, and found that, at each systole of the heart the volume of the blood ejected exactly equals that which the same animal shows under normal pressure. Thus if the tension of the oxygen breathed is reduced one half the effect on the circulation is as slight as it is on the respiration. With still greater rarefaction the oxygen tension in the alveoli can, by deeper respiration, still be brought to the level where the hæmoglobin of the blood is saturated, and no distress appears. Dr. Loewy drew interesting conclusions from his experiments in relation to the meaning of mountain sickness.—Prof. A. Kossel, in his further researches on thymin, a decomposition product derived from nucleic acid extracted from the thymus, has obtained a substance which gave all the reactions of levulinic acid, and produced a salt with silver which possessed exactly the crystalline form of the silver salt of levulinic acid. As levulinic acid originates from levulose, and is viewed by many chemists as proof of the presence of levulose, so from the above reaction the presence of a carbohydrate in nucleic acid is to be deduced. The origin of the nucleic acid is indifferent for this reaction, since it was found with all nucleic acids, a very important fact in relation to the physiology of metabolism. The attempt to discover a carbohydrate in the atom complex of casein, closely related to nucleic acid, led to the discovery of a substance which gave all the reactions of levulinic acid, with the exception of the levulinic acid salts, so that a certain conclusion as to the presence of a carbohydrate complex in casein cannot be drawn.

Physical Society, April 20.—Prof. du Bois Reymond, President, in the chair.—Prof. Koenig reported on a form of colour-blindness lately examined by him, which had not been observed before. The typically colour-blind see yellow in the spectrum where the normal eye perceives red, and the yellow continues with increasing admixture of white until the middle of the spectrum, about $\lambda = 530\mu\mu$, where it commences to change to pale blue which becomes continuously deeper until, at the violet end of the normal spectrum, deeply saturated blue is perceived; in the totally colour-blind, as is well known, every colour sensation has vanished; they see in the entire spectrum only white, which attains its greatest intensity about where the normal eye sees green. The typically colour-blind fall into two groups, which differ only in the position of the greatest brilliancy of the spectrum, the maximum in the one lies where the normal eye sees orange, about $650\mu\mu$, in the other it lies at the yellow, near $580\mu\mu$. The newly investigated case of colour-blindness showed a condition intermediate between typical colour-blindness and total colour-blindness. In the entire spectrum only white was seen, but at the red end of the spectrum the white was mixed with a very weak yellow, and at the violet end with a very weak blue. These colours were first perceived when the two ends of the spectrum lay next one another, and were compared. The maximum brilliancy lay in this case where the second group of typically colour-blind show it—near $580\mu\mu$. The present theories of colour perception are unable to explain this new case. [In the report of the meeting of the Physical Society for March 2 (NATURE, vol. xlix. p. 595), for Roepsel read Koepsel, and for Hulske read Halske.]

SYDNEY.

Linnean Society of New South Wales, March 28.—The following papers were read:—Notes on Australian *Typhlopidæ*, by Edgar R. Waite. Two new species were described—*T. batillus*, from New South Wales, and *T. diversus* from Queensland. Some discrepancies in the published descriptions of *T. unguirostris*, Peters, and *T. affinis*, Blgr. were pointed out. Three aspects of the head of *T. wiedii*, Peters, the only species hitherto unfigured, were given in order to complete the series. The measurements of a gigantic example of *T. polygrammicus* were recorded, the total length being 717 mm. (28½ inches).—On the fertilisation of *Clerodendron tomentosum*, R. Br., and *Candollea serrulata*, Labill, by Alex. G. Hamilton. The author showed that both plants possess contrivances for the purpose of ensuring cross-fertilisation. *Clerodendron* is proterandrous, and is fertilised by *Sphingidæ*, the pollen being deposited on the legs and underside of the thorax of the insects, a bending of the style keeping the immature stigma at this stage out of the way. After the pollen is shed the stamens curve downwards and the style straightens, bringing the now mature stigma into the position formerly occupied by the anthers. *Candollea serrulata* and its congeners have the anthers and stigma at the end of a sensitive column. This possesses a hinge, which if touched, causes the style to fly over. The anthers mature before the stigma, and at first conceal it. The flower is so constructed that when a bee thrusts in its proboscis, it inevitably touches the sensitive spot, and the style immediately flies over and clasps the bee, which then receives the pollen on its back. Later, when the pollen is all shed, the

stigma, which is papillose, grows out, and a bee visiting a flower is struck by the stigma, when the papillæ being glutinous receive the pollen. The author also noted some experiments and observations on the action of the sensitive column.—Note on Bungwall (*Blechnum serrulatum*, Rich.), an aboriginal food, by Thos. L. Bancroft. The rhizome of this fern formed, with the nuts of the Bunya Bunya (*Araucaria Bidwilli*), the most important food of the aborigines of Southern Queensland.—On the nests and habits of Australian *Vespidæ*, by Walter W. Froggatt.—Description of *Calliostoma purpureo-cinctum*, a new Australian marine shell, by C. Hedley. A small Trochoid, ornamented with beaded sculpture, and coloured orange with a spiral lilac band, was added to the local fauna under the above title.—Note on the habitat of the Naked-eyed Cockatoo (*Cacatua gymnopis*, Sclater), by Alfred J. North. Living specimens caught near Burketown in North Queensland, now on view in Sydney, have been examined; and there are specimens in the Macleay Museum from the Gulf of Carpentaria and from Port Darwin, and in the Australian Museum from Cambridge Gulf. The note of interrogation in the record of the habitat for this species given in the British Museum Catalogue of Psittaci ["South Australia (and also Northern and North-west Australia?")] may therefore be dropped.—Oological notes, by Alfred J. North, (1) *Ptilotis analoga*; (2) *Lamprococcyx malayanus*.—Observations upon the anatomy of the "dumb-bell-shaped bone" in *Ornithorhynchus*, with a new view of its homology, by Prof. J. T. Wilson. The "dumb-bell-shaped" bone is not confined to the palatine region, but both dorsally and posteriorly it is in intimate relation to the nasal septum. From the dorsal part of its hinder extremity it sends backwards a distinct vomerine spur, about 3 mm. in length, which is bifurcated posteriorly and grooved along its dorsal border, forming a splint for the ventral edge of the cartilaginous nasal septum. The tips of this bifid spur are connected with those of the anteriorly bifid end of the true vomer by means of a strong "vomerine ligament," varying in length from about 2 mm. downwards. In coronal sections this ligament is seen to possess the same sectional shape as the vomerine spurs, and to be structurally and morphologically continuous with the bone at either end. The vomerine spur lies quite dorsal to the palatine plate formed by the maxillæ, and it extends backwards to a plane from 2–3 mm. behind the tip of the anterior median process of the latter, from which it is separated by an interval. This interval forms a wide passage of communication (1 mm. vertically), below the nasal septum, between the nasal cavities of opposite sides, and it is lined by columnar epithelium like the neighbouring parts of these cavities. The "dumb-bell-shaped bone" is a true "anterior vomer" formed by the fusion of bilaterally symmetrical halves; and both in its nasal and in its palatine relations it resembles the palatine lobe of the vomer in *Caiman niger*.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, MAY 21.

ROYAL SOCIETY, at 4.30.—On the Dynamical Theory of Incompressible Viscous Fluids, and the Determination of the Criterion; Prof. O. Reynolds, F.R.S.—Measurements of the Absolute Specific Resistance of Pure Electrolytic Copper: J. W. Swan and J. Rhodin.—On some Voltaic Combinations with a Fused Electrolyte and a Gaseous Depolariser: J. W. Swan.—On certain Functions connected with Tesseral Harmonics, with Applications: Prof. A. H. Leahy.—On the Measurement of the Magnetic Properties of Iron: Prof. T. Gray.—Researches on the Electrical Properties of Pure Substances—No. I. The Electrical Properties of Pure Sulphur: Prof. Threlfall, J. H. D Brearley, and J. B. Allen.—On the Influence of certain Natural Agents on the Virulence of the Tubercle Bacillus: Dr. A. Ransome, F.R.S., and Dr. Delépine.

ROYAL INSTITUTION, at 3.—Egyptian Decorative Art: Prof. W. M. Flinders Petrie.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Cost of Electrical Energy: R. E. Crompton. (Continuation of Discussion.)

FRIDAY, MAY 25.

ROYAL INSTITUTION, at 9.—The Development of the Astronomical Telescopes: Sir Howard Grubb, F.R.S.

PHYSICAL SOCIETY, at 5.—On the Passage of Hydrogen through Palladium: Prof. W. Ramsay, F.R.S.

SATURDAY, MAY 26.

GEOLOGISTS' ASSOCIATION.—Excursion to Luton, Caddington, and Dunstable. Directors: Mr. John Hopkinson and Mr. Worthington G. Smith.

ROYAL BOTANIC SOCIETY, at 3.45.

MONDAY, MAY 28.

ROYAL GEOGRAPHICAL SOCIETY, at 2.30.—Anniversary Meeting.

TUESDAY, MAY 29.

ROYAL INSTITUTION, at 3.—The Modern Microscope: Rev. W. H. Dallinger, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Annual General Meeting.

SOCIETY OF ARTS, at 8.—Black and White in Africkanderland: W. A. Wills.

WEDNESDAY, MAY 30.

BRITISH ASTRONOMICAL ASSOCIATION (University College), at 5.

THURSDAY, MAY 31.

ROYAL SOCIETY, at 4.30.—The following Papers will *probably* be read:—Propagation of Magnetisation of Iron as affected by the Electric Currents in the Iron: Dr. J. Hopkinson, F.R.S., and E. Wilson.—On the Electrification of Air: Lord Kelvin, P.R.S., and Magnus Maclean.—Note on the Possibility of obtaining a Unidirectional Current to Earth from the Mains of an Alternating Current System: P. Cardew.—The Effect of Mechanical Stress and of Magnetisation on the Physical Properties of Alloys of Iron and Nickel and of Manganese Steel: H. Tomlinson, F.R.S.—The Root of Lygino'endron Oldhamia (Williamson): W. C. Williamson, F.R.S., and D. H. Scott.

ROYAL INSTITUTION, at 3.—Egyptian Decorative Art: Prof. Flinders Petrie.

CAMERA CLUB, at 8.30.—Twenty Thousand Feet over the Sea: Mr. Edward Whymper.

FRIDAY, JUNE 1.

ROYAL INSTITUTION, at 9.—The Work of Hertz: Prof. Oliver Lodge, F.R.S.

GEOLOGISTS' ASSOCIATION (University College), at 8.

SATURDAY, JUNE 2.

GEOLOGISTS' ASSOCIATION.—Excursion to Finchley and Whetstone Park Director: Dr. H. Hicks, F.R.S.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

BOOKS.—Twelve Charts of the Tidal Streams on the West Coast of Scotland: F. H. Collins (Potter).—The Tidal Streams of the Isle of Wight: F. H. Collins (Potter).—The Starry Skies: A. Giberne (Seeley).—This Great Globe: A. Seeley (Seeley).—Year-Book of the Scientific and Learned Societies of Great Britain and Ireland, 11th Annual Issue (Griffin).—The Metallurgy of Gold: T. K. Rose (Griffin).—Materia Medica, Pharmacology, and Therapeutics. Inorganic Substances: Dr. C. D. F. Phillips, 2nd edition (Churchill).—Journal of the Iron and Steel Institute, Vol. xliv. (Spon).—Manual of Practical Logarithms: W. N. Wilson (Rivington).—Die Anfänge der Kunst: Dr. E. Grosse (Freiburg i. B., Mohr).—Flora der Nordwestdeutschen Tiefebene: Prof. Dr. F. Buchenau (Leipzig, Engelmann).—The Lowell Lectures on the Ascent of Man: Henry Drummond (Hodder).—Royal University of Ireland. Examination Papers, 1893 (Dublin, Thom).

PAMPHLETS.—Botanical Charts and Definitions: A. E. Brooke and A. C. Brooke (Philip).—The Ethnography of Inishbofin and Inishshark, co. Galway: Dr. C. B. Browne (Dublin).—Scientific Taxidermy for Museums: Dr. R. W. Shufeldt (Washington).—Kew Observatory Report, 1893 (Harrison).—A Summary of Progress in Mineralogy and Petrography in 1893: W. S. Bayley (Waterville, Me.).

SERIALS.—Materials for a Flora of the Malayan Peninsula: Dr. G. King. No. 6 (Calcutta).—Journal of the Franklin Institute, May (Philadelphia).—American Naturalist, May (Philadelphia).—Journal of the Chemical Society, May (Gurney and Jackson).—Journal of the Polynesian Society, Vol. 3, No. 1 (Wellington, N.Z.).—Journal of the Institution of Electrical Engineers, No. 3, Vol. xxiii. (Spon).—Veröffentlichungen aus dem Königlichen Museum für Völkerkunde, iii. Band, 3/4 Heft (Berlin, Spemann).

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